PIMM

INCLUDING
DIE CASTINGS
MAGAZINE

Precision Metal Molding

FEBRUARY
1955

devoted exclusively to:

DIE CASTINGS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

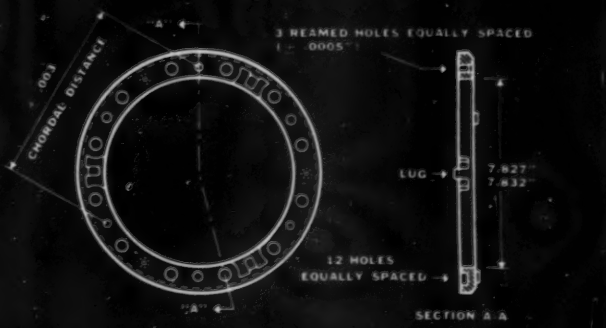
PLASTER MOLD CASTINGS

POWDER METALLURGY

SHELL MOLD CASTINGS

IN THIS ISSUE:

In heavy, earth-moving equipment, close-dimensioned zinc die castings are doing an important job as clutch ring followers. One dimension on the die casting is held to .005 over a span of nearly 8 inches.



See complete table of contents on page 3

Aluminum or Zinc Alloys

that always help you get better quality castings and trouble-free production

Aluminum ALLOYS

- All ingot produced for die casting, permanent mold and sand casting requirements have superior working characteristics and are free from impurities and gas.
- Composition is constantly checked during production to assure ingot meets your specifications.
- Orders are promptly processed and shipped with certificate of analysis.
- Shipments are palletized for fast, efficient handling.

ZINC BASE DIE CASTING ALLOYS Zamak

- All ingot is quality controlled during production to insure uniform quality metal.
- All alloys to your specifications.
- All shipments are palletized and shipped with a certificate of analysis.
- Deliveries are promptly made to meet your production schedule.

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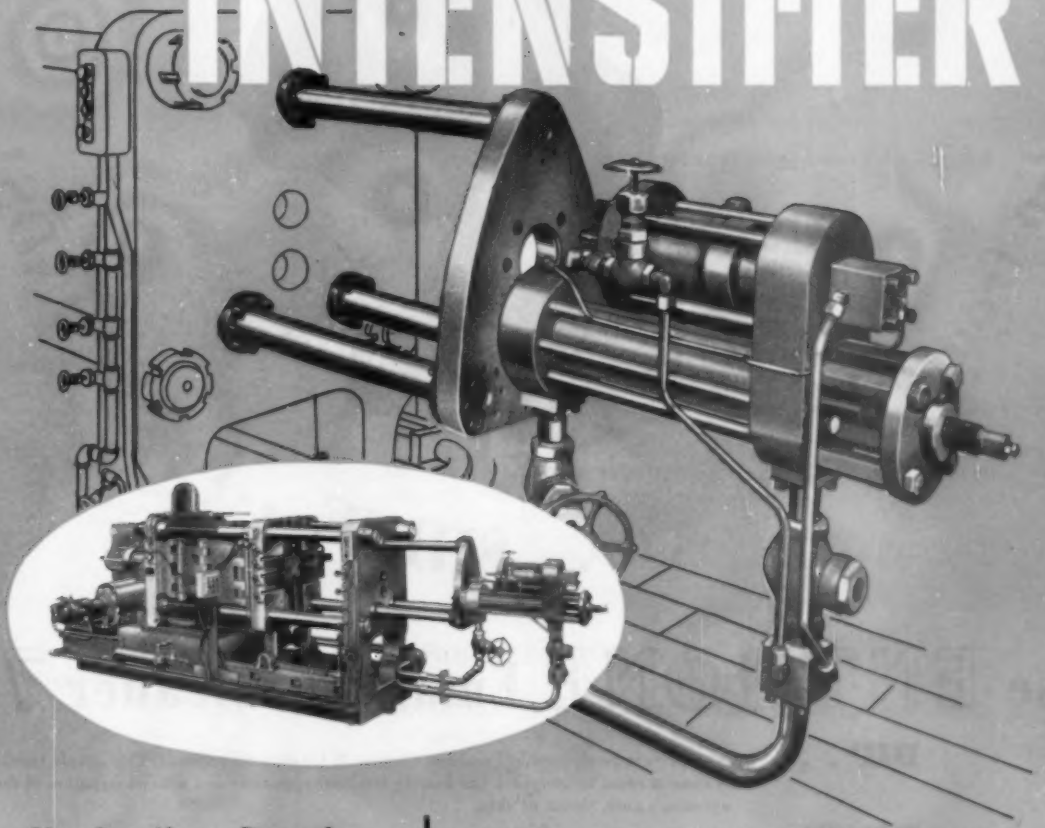
NOW AVAILABLE ON ALL CAST-MASTER COLD CHAMBER DIE-CASTING MACHINES

New... SHOT PRESSURE INTENSIFIER



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IN ADDITION to its many other efficiency features, CAST-MASTER now offers, as optional equipment, a new Shot Pressure Intensifier. This new Intensifier is engineered to operate without the use of time-consuming valves, permitting a simultaneous build up from the normal line pressure to intensified pressure without hesitation. The use of the new intensifier results in less porosity, producing castings with a mirror-smooth finish.

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Use ENTHONE Emulsion Cleaner 75

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INSURE . smooth, bright, adherent electrodeposits.

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pmm

February 1955

Volume 13 Number 2

precision metal molding

DIE CASTINGS
INVESTMENT CASTINGS
PLASTER MOLD CASTINGS
PERMANENT MOLD CASTINGS
POWDER METALLURGY
SHELL MOLD CASTINGS

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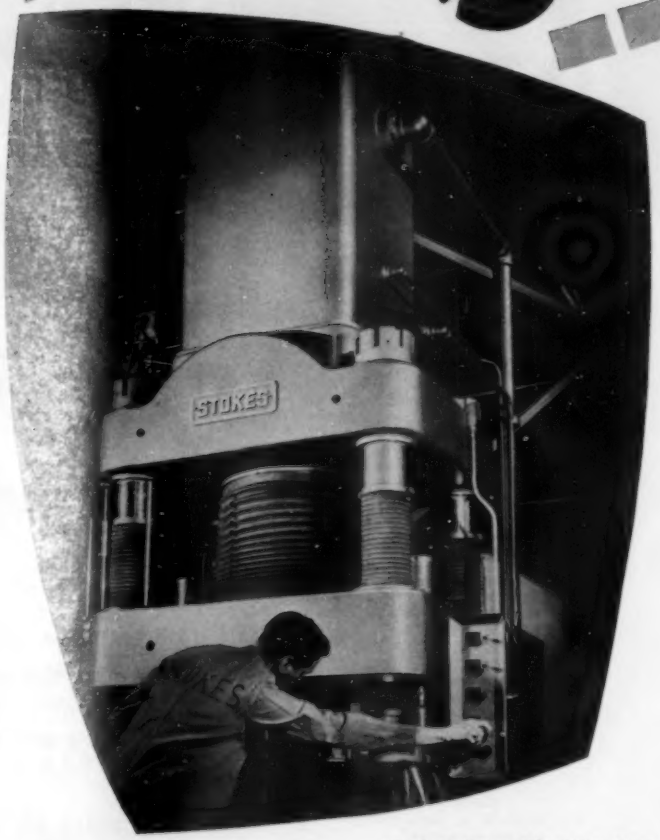
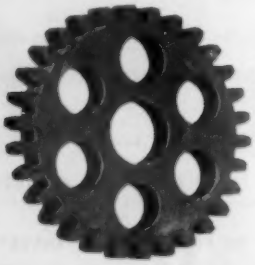
A valve disc sleeve used in the air release mechanism of a Neptune Red Seal petroleum meter was originally made of brass rod stock, then of die-cast zinc (which proved unsatisfactory) and now of powdered brass. Tolerances are ±.001" on two diameters. The part costs no more than the unsatisfactory die casting and approximately ½ that of the machined part.

This oil pump rotor is used in several IBM machines. Saving in cost as compared with machined parts, says IBM, is 84%! Total tolerances of .001" and .002" are required. Powder metal processing eliminates all machining operations, which previously required 20 hours per 100 pieces.



Making this intermediate wringer-drive gear of iron and copper powder saves its user, the Whirlpool Corporation, St. Joseph, Michigan, up to $20,000 per year. The part was formerly made from a ⅜" blank which was pierced, flattened, machined for teeth; wire brushed for burr. Tolerances on the powder metal part are identical with those obtained by machining.



The Stokes 300-ton Model 713 hydraulic powder metal press, a recent addition to the complete line of 16 Stokes fully automatic powder metal presses of 1½ to 500 tons capacity. Powder metal presses of the modern Stokes' line embody THIRTY YEARS of powder metal press research and engineering.

The parts illustrated on this page are made by the Presmet Corporation, Worcester, Mass., custom maker of high-precision powder metal parts . . . like most producers of powder metal parts, a user of Stokes powder metal presses.

Powder Metal Processing

Saves $20,000 a Year on this Part

Parts which are difficult to machine . . . parts which are wasteful of solid metal . . . are made in powder metal at great savings.

Fully automatic compacting of a broad selection of metal powders, pure or mixed, gives wide flexibility in determining tolerances, tensile strength, and functional characteristics, many of them unattainable in solid metal.

Stokes has over thirty years' experience in making presses *specifically* for powder metal processing. Stokes engineers are recognized for their broad contributions to the growing success of powder metal processing . . . will gladly contribute their experience to manufacturers interested in powder metal processing as a means of cutting costs and improving products.

Three booklets available: "Powder Metallurgy Today"; catalog of Powder Metal Presses (#801); and "How to Save Money on Punches and Dies". Send for any or all.

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Stokes is continually adding to its engineering and technical sales staffs in the high vacuum, industrial tabletting, powder metal and plastics molding fields. If you can qualify, there may be a position for you.

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A SCENE FROM A NEW FILM —SEE IT SOON!

DIE CASTING

RUSH

HOW ELSE WOULD YOU MAKE IT?

Learn what ZINC Die Castings can do for you...

Every design and production engineer should see the new motion picture "DIE CASTING—How Else Would You Make It?" as soon as possible. Produced by the American Zinc Institute, Inc., this brand-new film not only establishes the relationship of die casting to other high speed production methods but it presents the place of zinc among the die casting metals.

Included in the new 35-minute picture are all phases of the die casting process—part design, die design, casting, machining, finishing, and the fields of application. The above picture, for example, is one from a sequence dramatically describing the casting of the 5-foot, one piece Packard radiator grille frame and explaining why it is ZINC. Even though you are now using die castings in the assembly of your products, the film will help you to re-evaluate the die casting process in the light of the latest improvements in this constantly developing industry.

HOW TO SEE THE NEW FILM—
If you have access to projection equipment (the film is 16 mm. Kodachrome with sound) and can arrange to get a group together to see the picture, a print can be borrowed free of charge from the American Zinc Institute, Inc., 60 East 42nd Street, New York 17, New York. When writing, try to give several alternate dates for the showing and advise the size of the audience (you will also receive copies of a new 24-page booklet on die castings for those viewing the film).

The New Jersey Zinc Company
160 Front St., New York 38, N. Y.

ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

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Die castings to specifications . . . that's our specialty. You'll get the job done the way you want it when you specify Racine, and you can be sure your tools and dies are fully protected in our special fireproof storage vaults. We invite your inquiries and will welcome an opportunity to serve your die casting requirements.

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Tamms

SPECIAL SILICAS

WRITE FOR PRICES

AMORPHOUS
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DIATOMACEOUS

SIZE RANGE FROM 100 TO 600 MESH

All grades of silica ideal for precision casting by the investment molding process

•

Will meet the exacting requirements of most precision casting work

•

Precision quality to assure uniform casting performance

AND SAMPLES

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BETWEEN THE LINES

WHAT DO TEST BARS PROVE? Can the performance of an investment cast piece be properly evaluated in terms of tests performed on sample bars cast in the same flask? What about test bars machined from a portion of the casting? What part do process variables play in the relative properties of test bars vs castings? There is no simple answer to any of these questions, but some basic considerations that should be recognized by the designer are offered in a paper beginning on page 55 in this issue.

CHEAPER THAN CAST IRON? Some folks in buying jobs have a fixed notion that gray iron castings are cheaper than anything. They probably are, if you don't consider anything but the price of raw material. But as soon as machining and other secondary operations have to be figured, gray iron can drink up a lot of dollars in skilled labor and expensive tools. That's why the processes that deliver finished or semi-finished pieces are steadily replacing rough gray iron castings. There's a good illustration of the way powdered iron has replaced cast iron on page 36.

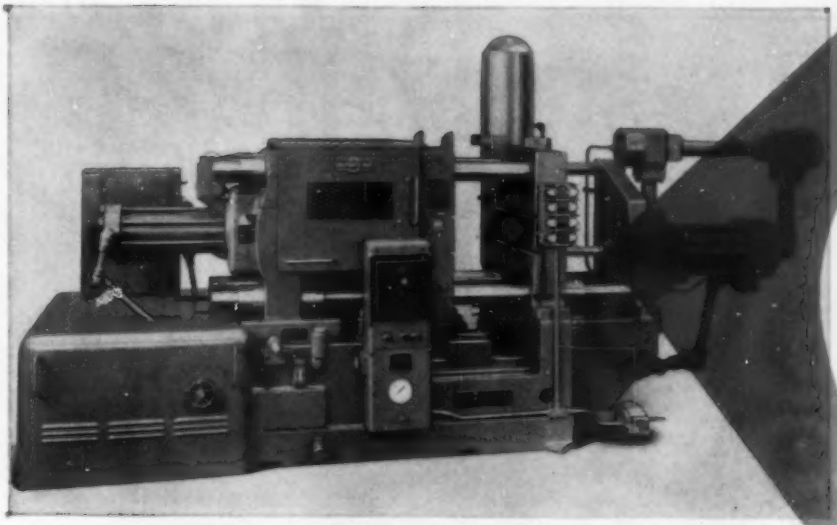
YOU CAN PLATE MAGNESIUM DIE CASTINGS. A report on methods for applying a decorative chromium plate over a magnesium die casting on a production basis is featured in this month's Finishing Section.

LARGE PERMANENT MOLD CASTING . . . the range of sizes and shapes that are being produced commercially will be reviewed, with pointers on design considerations to be remembered in connection with extra-large permanent mold castings. Coming soon.

SHELL MOLD CASTING. An introduction to the shell mold process is offered in this issue, covering what it is, where it can be used, what its advantages are, and some current applications.

A NEW METHOD FOR MACHINING TUNGSTEN. Pure tungsten is virtually unmachinable. Yet, a process has been developed for machining pure, sintered tungsten. This involves a special powder metallurgy technique that will be described in the March issue of PMM. It should be of interest to designers who would like to use this hard metal in forms that cannot easily be produced by conventional methods.

REED-PRENTICE
DIE CASTING MACHINES



plunger speed-- 10,000 in./min.

"HI-SPEED, HI-PRESSURE" PLUNGER Produces Dense, Uniform Aluminum and Magnesium Castings

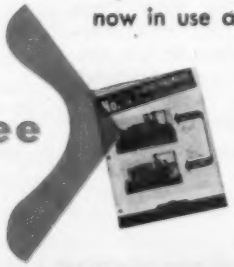
The Reed-Prentice "Hi-Speed, Hi-Pressure" plunger unit—available for both 1½G and 2G cold chamber die casting machines—increases plunger speed to 10,000 inches per minute and adds a final high pressure squeeze.

This results in extra-dense, porosity-free castings of uniform high quality . . . assuring you of repeat orders from your customers.

Capacities per shot of the 1½G and 2G are as follows:

Machine	*Magnesium*	*Aluminum*
1½G	2.5 lb.	3.75 lb.
2 G	6 lb.	9 lb.

The "Hi-Speed, Hi-Pressure" Plunger unit can be applied to machines now in use as well as to new machines.



free

Here's full information on the "Hi-Speed, Hi-Pressure" Plunger Unit. Write today for your copy.

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Affiliate of **PACKAGE MACHINERY COMPANY**

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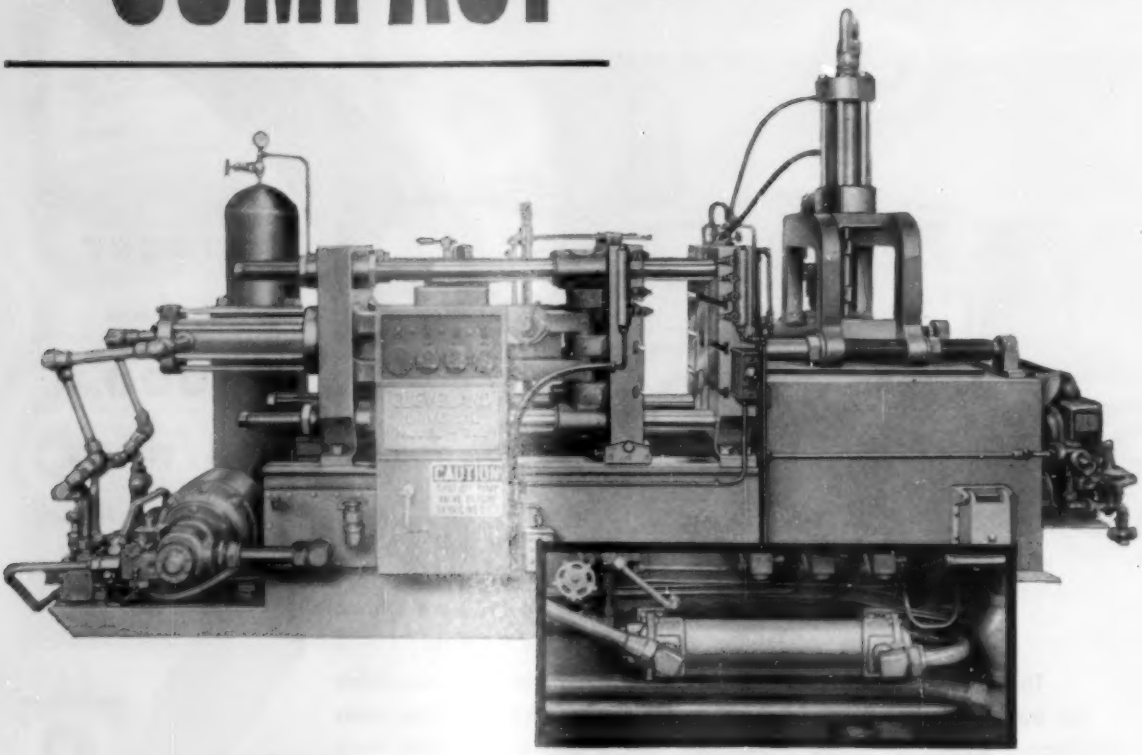
COMPACT ROSS EXCHANGERS



Insure rated pressures of Cleveland Die Casting Machines

With its hydraulic system designed to provide fast injection speed as well as the "squeeze" at the end of the shot, this Cleveland Model 200 Die Casting Machine has a rated locking pressure of 200 tons.

To maintain full capacity of the machine's high-pressure, two stage pump by preventing slippage from overheated, thinned, hydraulic oil, a Ross Type BCF Exchanger has been factory-installed. *Dependable cooling is assured!*

"All models of Cleveland Die Casting Machines use Ross Exchangers because we have found them very efficient in keeping the temperature of the hydraulic fluid constant at all times. Furthermore, the size of the Ross Cooler lends itself to easy mounting on our machine," says The Cleveland Automatic Machine Company.

Unrivaled for thermal efficiency and ruggedness, all copper alloy Ross Type BCF Exchangers are preferred for numerous types and makes of hydraulic machinery. Pre-engineered and fully standardized, they are stocked in a wide range of sizes to meet your needs . . . *promptly*.

For detailed information, request Bulletin 1.1K5.

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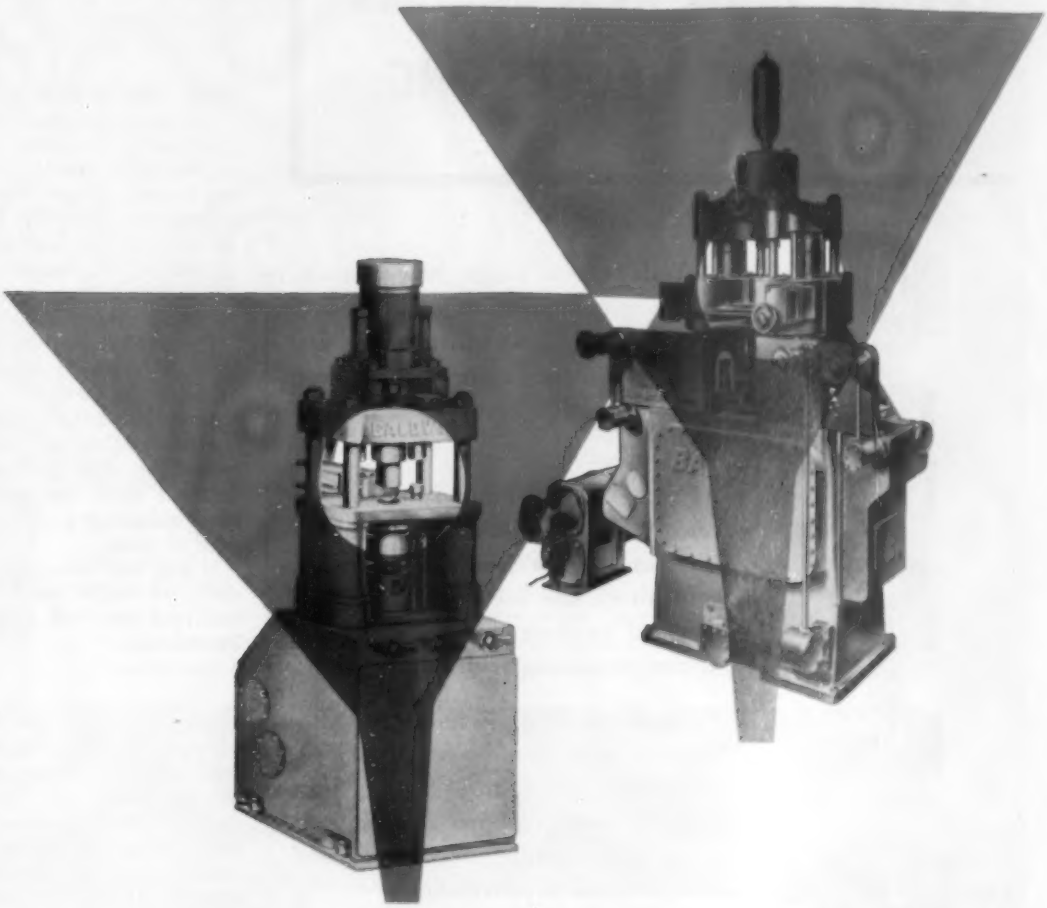
PRECISE FILLING OF DIES *by new Baldwin powdered metal presses makes compacts more uniform . . .*



THEIR highly efficient shuttle type feeders enable Baldwin's new Model "L" and Model "C" powdered metal presses to compact parts much more uniformly. Air operated and cam controlled, this unique feeder moves from under a stationary hopper to a position over the die. It carries the same volume of material over the die cavity each time with a very smooth motion.

This shuttle is supported on guide rods with a spring loaded cutoff ring which prevents loss of material. Cleanline design of the feeder eliminates those recesses or projections that might keep the powder from filling the die cavity completely.

This is just one of the ways you'll benefit by specifying Baldwin Model "L" (50-ton) or Model "C" (100-ton) presses to meet the growing demand for powdered metal parts. These new presses are the very first designed specifically for use in compacting metal powders. Both feature sealed mechanisms, hydraulic heads, special fill adjustments, automatic lubrication and variable cycling.

For our new bulletins on "L" and "C" please write promptly to our Dept. 4756, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

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EVERY MAN RESPONSIBLE FOR HEAT PROCESSING

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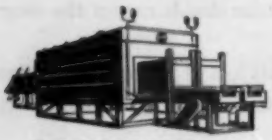
STRAND ANNEALING

CONTINUOUS MESH BELT CONVEYOR


TWIN AND SINGLE MUFFLE PUSHER

● Today's new alloys, new ceramics and new combinations of both have created new opportunities *and new problems* for executive management, engineers, metallurgists and production men.

As designers and builders of modern custom-tailored high temperature electric furnaces for America's foremost companies, the men of Harper are qualified to share the latest thinking in heat processing with you.

"The Harper Way" is to begin with a study of your product and then develop the type of process and type of heat processing equipment which best meets your quality, production and cost-per-piece requirements.

We invite you to take advantage of the specialized experience of Harper engineers as an aid in working out the most economical answer to your "jet age" requirements. Your request for a discussion is bound to result in a worthwhile exchange of thinking.

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DIES FOR SOUTH AMERICA

We have customers in South America in the metal fabricating business, having a die casting machine for aluminum, magnesium and brass. They are interested in buying used moulds of discontinued items which could be manufactured in South America.

From what we can find out, this will be a very difficult task, as we understand that most of the moulds in the possession of the die casting companies are owned by third parties; very unusual that the owners of these moulds are willing to dispose of them.

If you can offer any suggestions, we would appreciate the information.—E.J.M. (Vice President).

Dies are the property of the company buying the die castings, and are rarely available for purchase, even after the dies are obsolete. However, on the chance that some of our readers have dies they are willings to sell, we offer the above inquiry.—Ed.

LEAD CASTINGS

May we ask that you kindly send us a reprint of an article which appeared in the September 1954 issue of your magazine written by H. E. Zahn regarding dross effects minimized by withdrawing metal below the melt surface and conducting it to the mold through a closed pipe.—C.K.

Tear sheets of this article describing improved lead permanent mold castings used in lead-acid storage batteries have been forwarded.—Ed.

HYDRAULIC DANGER ZONE

Ordinary hydraulic fluid, escaping under pressure, can start a fire 40 ft. or more from a broken line! Is your plant safe? Here's how one firm protects men and machines inside the danger zone . . .

MEN POUR MOLTEN ZINC JUST 4 FT. AWAY FROM SAFE PYDRAUL LINES

PEAT MANUFACTURING CORP., NORWALK, CALIF., now uses fire-resistant Pydraul F-9 hydraulic fluid in 6 die-casting machines. Two years ago, ordinary fluid started a plant fire. But recently, when Pydraul splashed from a broken line into molten zinc there was no fire. Pydraul protects men working near machines like the new Kux unit, above, which operates at 800° F., 16 hours a day!

PROOF OF PYDRAUL SAFETY... In top photo, ordinary hydraulic fluid sprayed into oxyacetylene torch burns explosively. Below, Pydraul does not!

TOPS IN LUBRICATION TESTS... Timken Lubricant Test shows Pydraul has film strength of 17,500 psi . . . common water-base fluid, only 3,700 psi! In Almen Wear Test, using Pydraul, only 2 mg. of metal was lost in 20-minute run. Using petroleum oil, metal seized in one minute under the same load.

RE-USABLE, CAN'T CORRODE! Pydraul offers low make-up rate, high stability, can be re-used over and over again. And because it has a chemical base—not water—Pydraul can't corrode metal parts. For safety and savings, install Pydraul!

Pydraul: Reg. U. S. Pat. Off.

Write for the FREE new booklet, "Pydraul F-9," Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-V, St. Louis 1, Mo.

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY WHICH SERVES MANKIND

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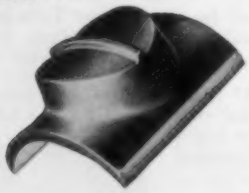
The striking difference in color shows comparative resistance to oxidation, proves superiority of RESISTOX Metal Powder (left) when exposed same length of time as ordinary powder.

Resistox Process gives Glidden Metal Powders more stability through greater resistance to oxidation!



Glidden Resistox Metal Powders offer you distinct storage and production advantages over ordinary metal powders because they resist oxidation from 5 to 10 times longer!

This exclusive Resistox Process permits storage over long periods of time without fear of oxidation, thus eliminating production and product-quality problems.

Glidden Resistox Metal Powders meet every requirement for uniformity, purity, consistency, strength. There is less material waste and die wear. They permit faster production of precision parts with greatly improved finish, appearance and performance characteristics.

Let us supply you with more complete information on these Glidden products: Resistox Copper and Lead Powders, Cuprous Oxide, Cupric Oxide and Cubond (Copper Brazing Paste). There's no obligation.

THE GLIDDEN COMPANY

CHEMICALS • PIGMENTS • METALS DIVISION

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QUALITY Glidden PRODUCTS

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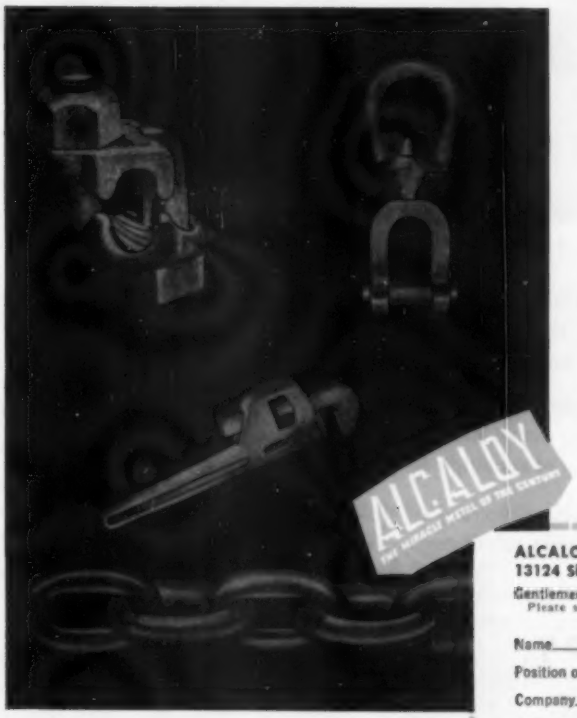
New ALCALOY CASTING PROCESS *gives you Today's Best Buy in* BRONZE CASTINGS

Here's the bonus you get when you put Alcaloy bronze castings to work on your job:

ECONOMY—Our process, combined with our new alloy, enables us to secure results which have been obtainable only by more expensive methods. Machining is reduced or completely eliminated. Scrap loss is reduced to a new low. Less shop equipment is needed. These add up to greater profits for you. What's more, in many instances the first costs of Alcaloy castings are lower than any other type casting.



Alcaloy, an alloy of aluminum, copper and other components, lends itself to a wide variety of products for commercial and specialized engineering purposes, including tools, utensils, machine parts, chain and fittings.

Alcaloy is cast in permanent molds by our own special process which produces castings uniformly close-grained, clean, sound throughout and free from cavities and surface flaws. All dimensions are held within specified tolerances. Experienced metallurgists test, analyze and supervise every phase of production.

Alcaloy is attractive and stays attractive. Its natural light gold-like bronze color remains free from tarnish and pitting . . . an ideal material where attractive appearance adds to fine quality.

Check these Alcaloy Features Today!

ECONOMICAL
NON-SPARKING
NON-MAGNETIC
CORROSION-RESISTANT
(except concentrated nitric acid)
UNIFORM

STRONG—Some grades of Alcaloy have the strength of steel and hardness of C 35-40. This strength is retained and utilized to the fullest extent in the casting process.

Send today for free catalog and information which will help you in specifying Alcaloy in your products.

ALCALOY, INC.

13124 Shaker Square • Cleveland 20, Ohio

Associated with
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ALCALOY, INC.
13124 Shaker Square • Cleveland 20, Ohio

Gentlemen:
Please send free catalog A and information on the new Alcaloy casting process to:

Name_____

Position or Title_____

Company_____

Address_____

City_____ Zone_____ State_____

For more information circle No. 9 on the Reader Service Card

Plus Factors

IN DESIGNING

WITH MADISON-KIPP

ZINC AND ALUMINUM DIE CASTINGS

(Gear Frame for Cream Separator made by Madison-Kipp for Perfection Manufacturing Corporation, Minneapolis, Minn.)

The plus factors in the die casting here illustrated are many. Seasoned skills were required by both the product designer and the die designer to combine several units in one piece.

Please note the ribbed double A frame construction, the coring from 6 sides, the in-line shaft holes, the general eye appeal of a multiple functional part.

Madison-Kipp die castings often add plus factors including the important one of profit.

kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• **Skilled in Die Casting Mechanics** • **Experienced in Lubrication Engineering** • **Originators of Really High Speed Air Tools**

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Celanese*

CELLULUBE*

SAYBOLT SECONDS @ 100° F.

90 150 220

The new Cellulube series of fire-resistant hydraulic fluids — in 3 viscosity ranges — clears the way for many new applications.

In addition to fire resistance and excellent lubricity, Cellulube hydraulic fluids have the following advantages:

non-corrosive	low volatility
controlled viscosity	thermal stability
non-foaming	high boiling point

In the die-casting field, Cellulube 150 and 220 are already standard hydraulic fluids. Now Cellulubes find applications in . . .

furnace combustion controls in steel mills and oil refineries . . . coke ovens, furnace tilters, loaders and ingot carriers . . . electrical welders, extrusion presses, forging and multiple action presses.

Your Celanese representative will be glad to give you full details. Or write for samples and technical data to:
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Chemical Division, Dept. 589-B
180 Madison Avenue, New York 16.

Celanese* CHEMICALS

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HYDRAULIC FLUIDS SPECIALLY ENGINEERED FOR SPECIFIC APPLICATIONS

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DATA OFFERED IN THIS MONTH'S ADS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

2. DIE LUBRICANT for fast, efficient casting release in die casting is described in bulletin 426-K and reprint DC, both available from Acheson Colloids Co.

7. ALUMINUM ALLOY for superior die castings is described and the chemical and mechanical properties listed in bulletin Z-39 published by Apex Smelting Co.

9. BRONZE CASTINGS that are non-sparking, corrosion-resistant and non-magnetic are fully described and properties tabulated in new catalog A from Alcaloy, Inc.

12. METAL POWDER PRESSES incorporating several advanced features and combining both hydraulic and mechanical actions are described in bulletins issued by Baldwin-Lima-Hamilton Corp.

13. ALLOYS FOR INVESTMENT casting are described and their chemistry and as-cast properties given in the new MasterMet bulletin issued by Cannon-Muskegon.

14. DIE CASTING MACHINES are the subject of a specification catalog available from Cast Master.

15. FIRE-RESISTANT hydraulic fluids in three different viscosities are described and technical data on them given in data sheets from the Celanese Corp. of America.

20. METAL CLEANING with Emulsion Cleaner is described in detail in data sheets from Enthone, Inc.

21. ADJUSTABLE DRILL HEADS. A new bulletin, No. 600, has been published by Ettco Tool Co., Inc. which describes its flexible shaft multiple spindle adjustable drill heads.

22. SMALL PARTS PRODUCTION by die casting in zinc is fully described and illustrated in a new fact-filled bulletin available from Gries Reproducer Corp.

23. NON-FERROUS METAL powders for the powder metallurgy industry are described in technical data available from the Glidden Co.

25. DIE CASTING METAL, data on available alloys, and other information of value is in the monthly "Henning Messenger", published by Henning Bros. & Smith, Inc.

28. DIE CASTING MACHINES featuring a new mechanical clamp said to give positive die locking are described in the new Bulletin 5400 published by Hydraulic Press Mfg. Co.

30. DATA BOOK on HVA electrolytic iron powders is offered by A. Johnson & Co., Inc.

32. HEAT EXCHANGERS for die casting machines and similar applications are described and engineering data given in a bulletin from Kewanee-Ross.

33. DIE CASTING MACHINES. A detailed catalog giving sizes, capacities, operational data and typical examples of the work done on the machines is available from the Kux Machine Co.

34. DIE CASTING MACHINES. A new, complete bulletin on die casting machines and accessories is offered by Lewis Welding & Engineering.

35. DIE CASTING DESIGN in aluminum and magnesium is discussed in literature that is available from Litemetal Dicast, Inc.

37. HINGED STEEL BELTING and its applications are described in bulletin MF-530 that has been prepared by May-Fran Engineering, Inc.

40. FIRE RESISTANT hydraulic fluid that brings a new measure of safety to hydraulic systems in hazardous locations is described in a booklet, "Pydraul F-9" that has been prepared by Monsanto Chemical Co.

41. SINTERED BUSHINGS and machine parts are described in literature available from National Molded Products, Inc. A listing of standard sized bushings available from stock is included.

47. CASTING WAX. Technical data on casting waxes for the investment casting industry has been published by the Petrolite Corp.

49. DIE CASTING MACHINES for both zinc and aluminum are fully described and their capacities given in literature that is available from Peco Machinery Sales, Ltd.

50. DIE CASTINGS. The Precision Castings Co. has just published a new highly informative 24 page brochure "Die Castings . . . Unlimited" giving the story of their integrated service.

51. DIE CASTINGS to exact specification is the subject of a new booklet that has been prepared by the Racine Die Casting Co.

52. DIE CASTING MACHINES featuring high speeds and high pressures are described in the latest catalog from Reed-Prentice Corp.

57. MACHINING ALUMINUM is the subject of a new, comprehensive booklet that has been prepared by the metallurgical department of The George Sall Metals Co., Inc.

58. METAL POWDER PRESSES for forming parts by powder metallurgical techniques are described and illustrated in catalog No. 801 from the F. J. Stokes Machine Co. Also available are two other booklets, "Powder Metallurgy Today" and "How to Save Money on Punches and Dies."

61. DIE CASTINGS. A catalog describing and illustrating the complete facilities from design to plating and assembly has been issued by Tri-State Die Casting Corp.

63. PLASTIC INJECTION PRESSES for polystyrene patterns and other plastic parts are described in literature from Van Dorn Iron Works Co.

64. METAL POWDER PARTS can cut production costs and improve products. A booklet from the Powdered Metal Products Div. of Yale & Towne Mfg. Co. gives the complete story.

67. AIR CYLINDERS with built-in valves are described in bulletins SP-50 and CL-50 from The Bellows Co.

68. COST CUTTING with a chromate conversion coating and the many applications of this type of surface finish is covered in technical data sheets from the Chemical Corp.

69. BARREL FINISHING of a wide variety of parts and many different materials is described in a new technical bulletin "Facts and Figures Report on Honite Barrell Finishing" from Minnesota Mining & Mfg. Co.

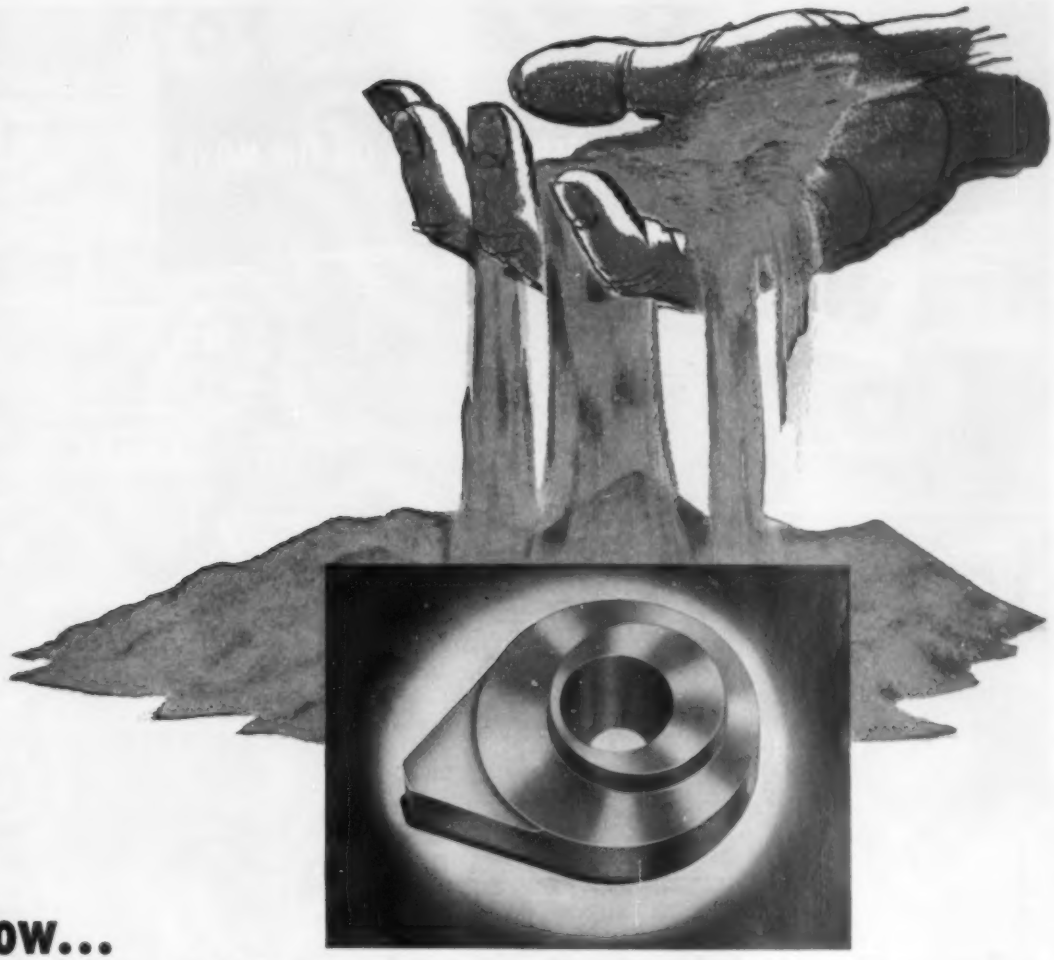
70. CHAMFERING & DEBURRING, both inside and outside, can be done rapidly and economically. Operational data and tool descriptions are available from Nobur Mfg. Co.

71. METAL CLEANING ideas are included in a 44-page booklet from Oakite entitled "Some Good Things to Know About Metal Cleaning."

75. SHELL MOLDING MANUAL. An all new, 28 page manual has been issued by General Electric Co. on the shell mold casting process. Technical data on resin bonding and silicone release agents are included.

76. DIE CASTING machine parts and reconditioning service on shot sleeves goose-necks, etc. are offered by the Martin Grinding & Machine Works, Inc. A brochure is available describing the services and facilities.

Continued on page 27



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from America's finest precision parts plant you can get Highest-Quality Powder Metal Parts

Your most rigid specifications for top-quality powder metal parts of all alloys can be met fully and promptly by the Metallurgical Products Division of Thompson Products. Our experience in producing millions of parts to commercial and aircraft tolerances enables us to supply accurate, properly engineered parts in large or small quantities at lowest prices compatible with highest quality. This engineering and metallurgical experience can help you redesign to fully utilize the strength and economy of powder.

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Let us help you take full advantage of a shift to powder metal parts. We'll be glad to advise on engineering and design. To find out more about Thompson's facilities, write for Booklet MP-532.

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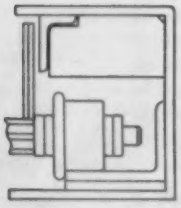
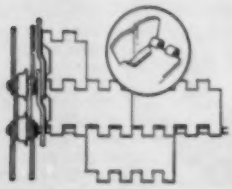
For more information circle No. 77 on the Reader Service Card

May-Fran hinged-steel conveyor belts



Construction details of "skirt" which prevents entry of foreign matter and protects side chains.



Outside links incorporate interlocking wings . . . remain positively engaged at all times.

For more efficient, more economical production in your plant . . . mechanize the handling of die castings. MAY-FRAN Hinged-Steel Belting keeps castings on the move . . . continually . . . automatically. Saves handling equipment, saves aisle space, saves manpower.

MAY-FRAN Hinged Steel Conveyor Belting withstands hot, heavy or abrasive parts . . . is built for long life and maintenance-free operation. Precision formed, heavy-gauge hinged-steel links are connected in horizontal rows by means of high-carbon steel rods. Side chains are an integral part of the belt . . . interlocking wings remain positively engaged, even when traveling over sprockets.

MAY-FRAN Hinged-Steel Belting can be furnished in widths from 6 inches to 6 feet . . . in any length . . . in any carrying capacity . . . with solid or perforated links in 2½ to 12-inch lengths.

For complete information, write today for Bulletin MF-530.

DESIGNERS AND BUILDERS OF COMPLETE HANDLING SYSTEMS

MAY-FRAN ENGINEERING, INCORPORATED

1686 Clarkstone Road • Cleveland 12, Ohio

For more information circle No. 37 on the Reader Service Card

Properties & Constants of Zinc Alloys for Die Castings

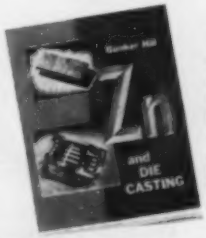
Zn

DESIGNATION	ASTM SAE	XXIII 903	XXV 925
MECHANICAL PROPERTIES *	Charpy Impact Strength, ft.-lb., ¼x¼ in. bar, as cast	43	48
	Charpy Impact Strength, ft.-lb., ¼x¼ in. bar, after 10 years indoor aging	41	40
	Tensile Strength psi as cast	41,000	47,600
	Tensile Strength psi after 10 years indoor aging	35,000	39,300
	Elongation % in 2 in. as cast	10	7
	Elongation % in 2 in. after 10 years indoor aging	16	13
	Expansion (growth) inches per inch after 10 years indoor aging	.0001	.0001
OTHER PROPERTIES AND CONSTANTS (AS CAST) *	Brinell Hardness	82	91
	Compression Strength psi	60,000	87,000
	Electrical Conductivity—Mhos/cm at 20°C	157,000	153,000
	Melting Point—°C	386.6	386.1
	Melting Point—°F	727.9	727.0
	Modulus of Rupture psi	95,000	105,000
	Shearing Strength psi	31,000	38,000
	Solidification Point—°C	380.6	380.4
	Solidification Point—°F	717.1	716.7
	Solidification Shrinkage—Inch/Foot	.14	.14
	Specific Gravity	6.6	6.7
	Specific Heat—cal/g/°C	.10	.10
	Thermal Conductivity—cal/Sec/aqcm/cm/°C at 18°C	.27	.26
	Thermal Expansion per °C	.0000274	.0000274
	Thermal Expansion per °F	.0000152	.0000152
	Transverse Deflection—In.	.27	.16
	Weight (Lb.) Cubic Inch	.24	.24

*Compiled by American Zinc Institute from authoritative sources

OF THE FOUR ALLOYS most commonly used for die casting – those based on zinc, aluminum, magnesium and copper – zinc offers the greatest number of desirable mechanical properties and casting characteristics at low cost. Hence, for many years, zinc has been the most widely used die casting material. Following are the inherent characteristics which account for this preference: Zinc alloys can be die cast in the highest speed machines • They are cast at lower temperatures, which minimizes fuel, die cost and die upkeep • Their impact strength is greater than that of any of the other alloys except those based on copper • They lend themselves to die casting within close dimensional limits and in varying section thicknesses • They are easily machined and are frequently used in the "as cast" condition • They are readily finished with any commercial electroplated or organic coating.

It is essential that zinc die casting alloys be formulated with Special High Grade (99.99+% pure) zinc to meet the required low limits on contaminating elements. The exacting limits on these contaminants are established in standards of the American Society for Testing Materials and the Society of Automotive Engineers and strict adherence to these standards assures the realization of maximum physical and mechanical properties. Buyers of zinc die castings can receive assurance of these superior inherent properties through reliance on the Certified Zinc Alloy Plan of the American Die Casting Institute.



READ "Bunker Hill Zinc and Die Casting"... the story of DIE CASTING as a high-speed, low-cost production tool... ZINC and its advantages as a base metal for die castings... BUNKER HILL'S contribution to the phenomenal growth of the die casting industry. This new 8½ x 11", 24-page publication is yours for the asking. Write for copy on your company letterhead please.

BUNKER HILL 99.99+% ZINC

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Precision Made . . . For Precision Performance

POWDERED METAL PARTS

precision made from exclusively formulated non-ferrous Sintroloy and Ductiloy are molded to close tolerances, thereby eliminating machining of intricate shape and high scrap loss.

Perhaps we may be able to help you solve specific parts problems. Get in touch with National Molded today for prompt attention.

Write today for detailed information and free literature on cost-saving standard bearings which are available from stock.

NATIONAL MOLDED PRODUCTS, INC.

1942 MILL ST. • ST. MARY'S, PA.

SERVING THE MIDWEST with Quality ALUMINUM & ZINC Die Castings

Our fully-equipped plant is now serving some of the nation's largest manufacturers from the Great Lakes to the Gulf

Trimming • Machining
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Affiliate of Tri-State Plastic Molding Co., Inc.

For more information circle No. 61 on the Reader Service Card

BOOK REVIEWS

SHELL MOLDING AND SHELL MOLD CASTINGS

By T. C. DuMond,
Reinhold Publishing Corp.,
New York, N. Y. Price $2.00

In this, the first book on shell molding published, the author has attempted to evaluate the process and give its proper industrial perspective. In the main, he has been successful.

Based upon such information as is currently available and upon the fragmentary nature of most analyses that have been made, some suggested general rules of thumb are given. These will enable a potential user of shell mold castings to arrive at a first approximation of economics involved.

Several of the machines now available for making molds are described and illustrated and a number of case histories of parts made by the process are given.

NICKEL IN IRON AND STEEL

By A. M. Hall
John Wiley & Sons, Inc., New York, N. Y., Price $10.00.

This is the second volume in the Alloys of Iron Research Monographed Series published by The Engineering Foundation.

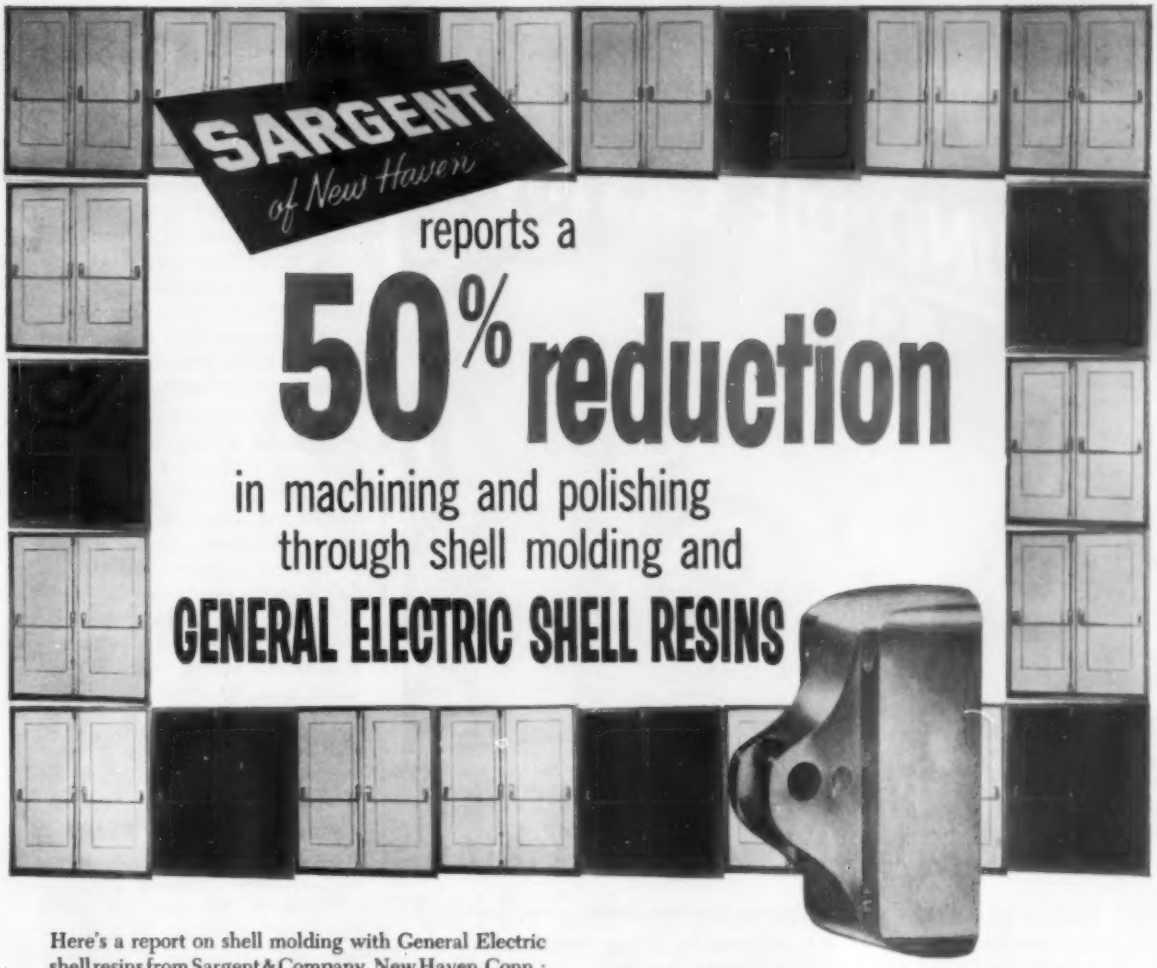
The author has covered the subject from the ores of nickel through the wrought and cast irons and steels.

The melting and working of the alloy steels is briefly discussed, more as an introduction to the properties than from any other point of view.

The sections on the metallography and heat-treatment of the nickel steels are exceptionally complete as are the portions dealing with both room temperature properties and the effect of temperature on properties.

Under the cast iron and cast steel sections the chemistry and properties are adequately covered and some attention given to applications.

Separate sections of the volume are devoted to welding, brazing, soldering, cutting, etc. of the nickel steels.



reports a

50% reduction

in machining and polishing
through shell molding and

GENERAL ELECTRIC SHELL RESINS

Here's a report on shell molding with General Electric shell resins from Sargent & Company, New Haven, Conn.:

"Shell molding with G-E shell resins has proved ideal for producing parts for our new line of 'Quick' Exit Devices. The shell process permits the use of hard, high-grade bronze—resulting in a completed product unsurpassed in finish and texture."

Machining, polishing operations cut in half! "Parts are *sounder*—have more uniform grain structure. They're *smoother*—free from surface gas holes. *Machining and polishing operations were reduced by 50%*. Over-all result: a product better in both strength and appearance, produced more quickly and easily, with faster deliveries so important to sales."

Sargent uses three General Electric shell-molding products to turn out "Quick" Exit Device parts: **G-E 12374 phenolic shell-molding resin** to form light, dimensionally accurate molds, **G-E SM-55 silicone parting agent** to secure quick, easy release of molds from patterns, and **G-E 12316 bonding resin** to cement shell halves together.

FREE BOOKLET AVAILABLE

How can shell molding help YOU? General Electric, a major supplier of molding and release agents for the shell process, has prepared an informative 28-page manual telling about the techniques and benefits of this new foundry method. *Just mail the coupon for a free copy!*

SEND COUPON TODAY FOR SHELL-MOLDING DATA!

General Electric Company
Section 418-4C, Chemical and Metallurgical Division
Pittsfield, Massachusetts

Please send me a free copy of *G-E Shell Molding Manual*.

☐ We are presently using the shell-molding process.
☐ We are interested in the shell-molding process.

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Progress Is Our Most Important Product

GENERAL ELECTRIC

For more information circle No. 75 on the Reader Service Card

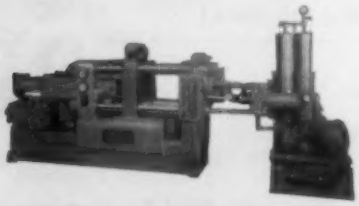
HOW TO GET SOUND DIE CASTINGS

NEW H-P-M Mechanical Clamp Assures Positive Die Locking

Here's why H-P-M's new die casting machine makes better castings: new positive clamping action is achieved by sliding wedges driven by knuckle-joint linkage which preloads the press frame and backs up the platen. The results . . . a minimum of flash . . . sound castings.

In this new H-P-M clamp mechanism there are no toggle pins under heavy shear load . . . no single line contacts . . . and no extremely high stressed members that normally result in high maintenance cost and down time.

These are just a few of the 40 new and improved features of the new H-P-M die casting machine. Write for Bulletin 5400, a completely illustrated story on this H-P-M line of profit makers.



THE HYDRAULIC PRESS MANUFACTURING COMPANY

1094 Marion Road
MOUNT GILEAD, OHIO, U. S. A.

HPM

For more information circle No. 28 on the Reader Service Card

NAMES IN THE NEWS

Two new appointments have been announced by *Behr-Manning Corp.* **Edwin C. Evans** has been made vice-president and assistant general manager. **William I. Clark, Jr.** is now assistant to the president in addition to his present position as secretary of the company.

The *Worthington Corp.* has announced several management changes. **Hobart C. Ramsey,** president, becomes chairman of the board, **Howard Bruce** becomes chairman of the executive committee. **Edwin J. Schwanhausser** is the new president and **Clarence E. Searle** is retiring as vice chairman of the board but will continue as a director.

John E. Fahlman has been appointed to the newly created post of executive vice president of the *Permold Co.*

James H. Wolcott has been appointed western sales manager of *Reed-Prentice Corp.*

Willis J. Wenger has been appointed assistant vice president of *Continental Foundry & Machine Co.,* roll dept.

John Love has been appointed supervisor-requisition engineering at the Norwood plant of the distribution assemblies dept. *General Electric.*

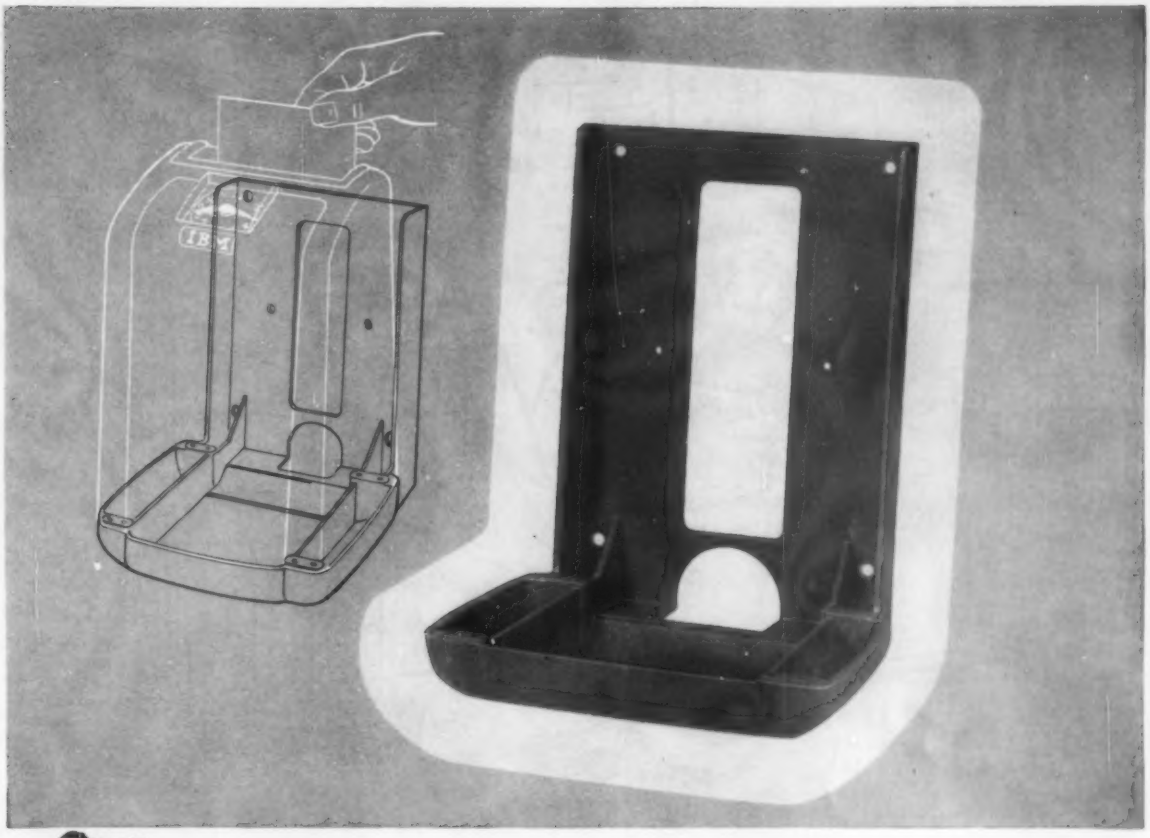
John A. Peloubet has been transferred from the magnesium sales section of *The Dow Chemical Co.,* New York office, to the magnesium department technical service and development group in Midland, Mich.

James M. Young, III and **Robert P. Keating** have joined the process study group of *Hooker Electrochemical Co.*

Norris H. Schwenk has been appointed general manager, and **James J. Nelson** sales manager of the foundry department, *Baldwin-Lima-Hamilton.*

Three new appointments were recently announced by

Continued on page 27



TIME MARCHES ON *automatically . . . supported by* PARKER DIE CASTINGS

PARKER SALES ENGINEERS

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Hodgson-Geisler Co. • 18917 James Couzens

GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F. Higgins, Jr. • 102 West Adams Street

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Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

IBM's fully-automatic, electric time recorder is a far cry from the old-fashioned time clock. This modern engineering development handles with ease and sureness any kind of work schedule, no matter how complex. To produce the wall mounting bracket shown above, IBM and Parker together worked out the design of the part. The result: a die casting that meets every specification at lower total cost.

This close co-operation from blue print to finished product typifies the complete engineering—as well as manufacturing—service offered by Parker. No matter how complex your die casting problem, Parker will be glad to help you find the answer. Just call the nearest Parker sales engineer listed at the left or write the factory direct.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER **ALUMINUM and ZINC *die castings***

For more information circle No. 46 on the Reader Service Card

cut downtime; avoid damaged dies

When you use **Die Slick**, you insure your operation against the many high costs of down-time. **Die Slick** prevents sticking, soldering, ejector pin wear, and die damage. On difficult jobs, it often makes the difference between failure and success. We are confident that a week's trial in your shop will show you how **Die Slick** pays off in more production and better quality. To be sure we send you the most effective grade of **Die Slick**, please specify the metal or alloy you're casting.

DIE SLICK®

used by die casters everywhere

G. W. SMITH & SONS, INC., 5400 KEMP ROAD, DAYTON 3, OHIO,

For more information circle No. 53 on the Reader Service Card

Here's real help for designers . . .

Prove To Yourself How High Density HVA Electrolytic Iron Powder Parts Perform In Your Product

If you have unsuccessfully tried powdered metal parts or never considered this process for structural parts because the *right combination* of *tensile strength, impact strength, elongation* and *wear resistance* was not available, then we have something to offer you — a convenient method for evaluating the properties featured at the right in your own parts.

HERE'S HOW IT WORKS

A recent service, which eliminates die costs, enables you to machine test parts from slugs supplied by us and compare them under actual conditions with conventionally made parts. Prove to yourself that high density powder metallurgy will replace complicated machined parts and forgings the same way Husqvarna evaluates parts in its own shops in Sweden.

Values in table obtained by double pressing and sintering cycle with low carbon content powder. For full particulars use coupon below.

Slugs have been prepared to the density conditions italicized.

ALLOYS		
DENSITY	**T.S. (p.s.i.)**	**ELONG**
1. HVA Electrolytic Iron		
7.23	*34,000*	*28.6%*
7.58	**39,000**	**35.5%**
2. HVA Electrolytic Iron plus 2% Copper		
7.20	*47,000*	*14.0%*
***7.20**	**65,000**	**8.5%**
7.47	**51,000**	**23.0%**
***7.47**	**69,000**	**9.0%**
3. HVA Electrolytic Iron plus 3% Copper		
7.22	**47,000**	**12.3%**
***7.22**	*83,000*	*6.7%*
7.43	**53,000**	**19.5%**
***7.43**	**90,000**	**7.5%**

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Gentlemen:
Please send me, at no obligation to myself:
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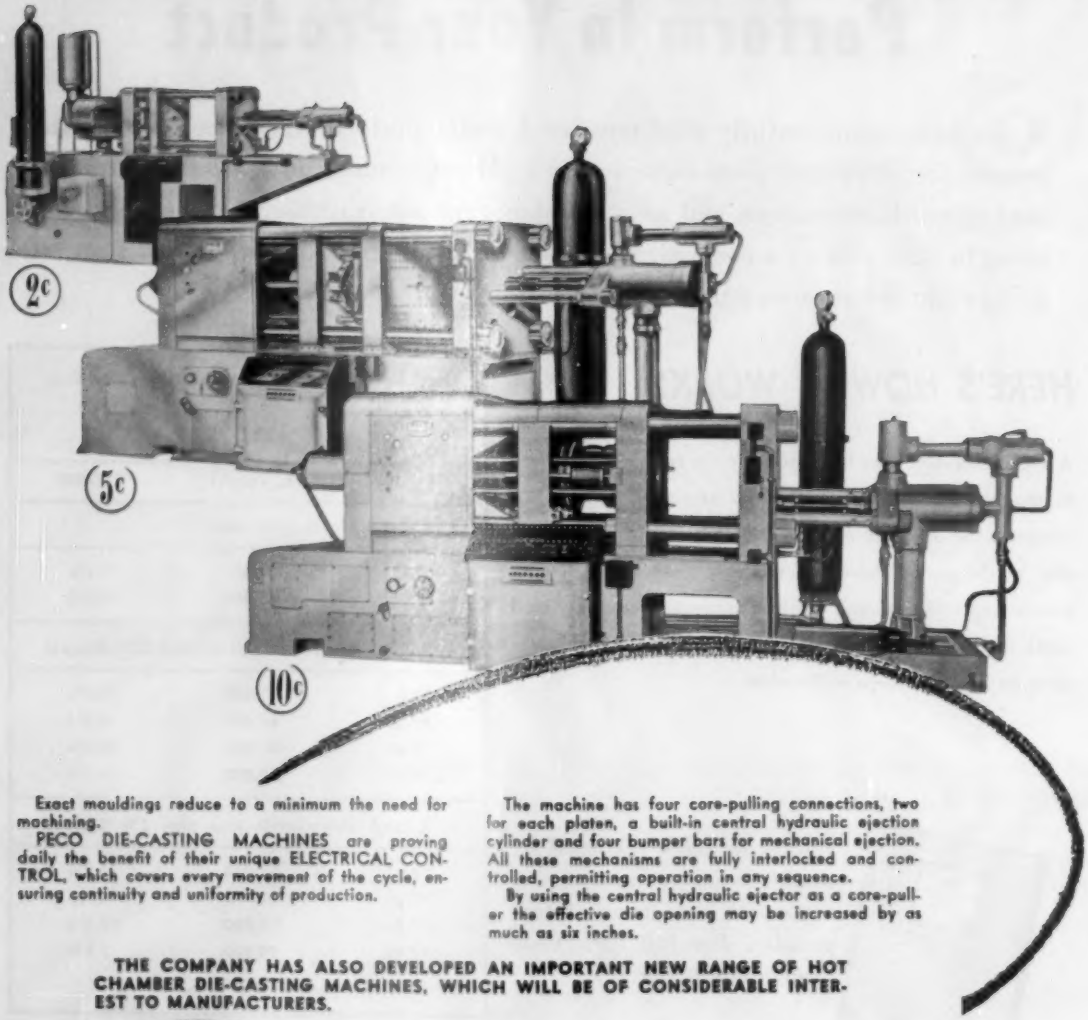
Thousands of Different Castings all with the same 'PECO' PRECISION



Exact mouldings reduce to a minimum the need for machining.

PECO DIE-CASTING MACHINES are proving daily the benefit of their unique ELECTRICAL CONTROL, which covers every movement of the cycle, ensuring continuity and uniformity of production.

The machine has four core-pulling connections, two for each platen, a built-in central hydraulic ejection cylinder and four bumper bars for mechanical ejection. All these mechanisms are fully interlocked and controlled, permitting operation in any sequence.

By using the central hydraulic ejector as a core-puller the effective die opening may be increased by as much as six inches.

THE COMPANY HAS ALSO DEVELOPED AN IMPORTANT NEW RANGE OF HOT CHAMBER DIE-CASTING MACHINES, WHICH WILL BE OF CONSIDERABLE INTEREST TO MANUFACTURERS.

PECO PRODUCTS

We shall be glad to forward to you on request fully illustrated literature on these machines.

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WORKS: THE PROJECTILE AND ENGINEERING COMPANY LIMITED, ACRE STREET, LONDON, S. W. 8, ENGLAND

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NAMES IN THE NEWS
continued from page 22

Allis-Chalmers Mfg. Co., general machinery div. **Martin L. Carson** is on special assignment in the vice president's office, **L. W. Long** is now general manager, Terre Haute Works; **John F. Chipman** is genera manager of the Boston Works

Col. Richard L. Hopkins has been appointed vice president of *American Electro Metal Corp.*

David J. Blythe has been appointed production superintendent, metals manufacturing, for *National Lead Co.*

William G. Gillett has been appointed works manager of the Culver City, Calif. plan of *Merit Products, Inc.*

Hjalmar Nilsson has been appointed chief engineer of *Magnesium Co. of America.*

Calvin J. Werner is the new general manager of the *Moraine Products Div., General Motors Corp.*

Boyd M. Johnson has been appointed general manager of the refractories division of *The Carborundum Co.* succeeding ***Clarence E. Hawke*** who recently retired.

James M. Dawson has been elected to the board of directors of the *Ferro Corp.* He replaces **Allen L. Billingsley** who died last October.

Douglas P. Ferguson has been appointed Ferrocarbo engineer in the Abrasive Engineering Dept. of the Bonded Products and Grain Div. of *The Carborundum Co.*

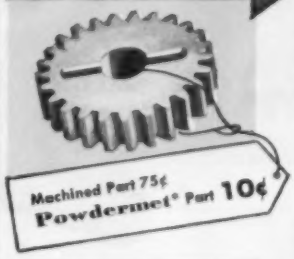
REFERENCE DATA
continued from page 16

77. FOR YOUR POWDERED METAL PARTS, Thompson Products Inc. has a complete contract production facility that is described and illustrated in a booklet issued by the company's Metallurgical Products Div.

DON'T CUT PARTS ...Cut Costs!

Why pour money into expensive machining operations?

POWDERED METAL PARTS can do the job for *much less!*



Tough, intricate parts ready for assembly without further processing—at *savings of up to 600% over identical machined parts!* No wonder industry chooses Powdermet.*

Low-cost PM parts are die-pressed to close tolerances, have excellent wearability, and a wide range of alloys are available—many exceeding the tensile strengths of mild steel. Through controlled porosity and electrical permeability, many special properties are achieved . . . such as oil-impregnation for life-time self-lubrication. That's why Powdermet* parts are often the *best parts possible* for gears, bearings, filters, etc.

At Yale & Towne, years of experience and technological know-how in powder metallurgy back up every recommendation on PM parts for *your* particular application.

Get your copy of this informative new booklet now!

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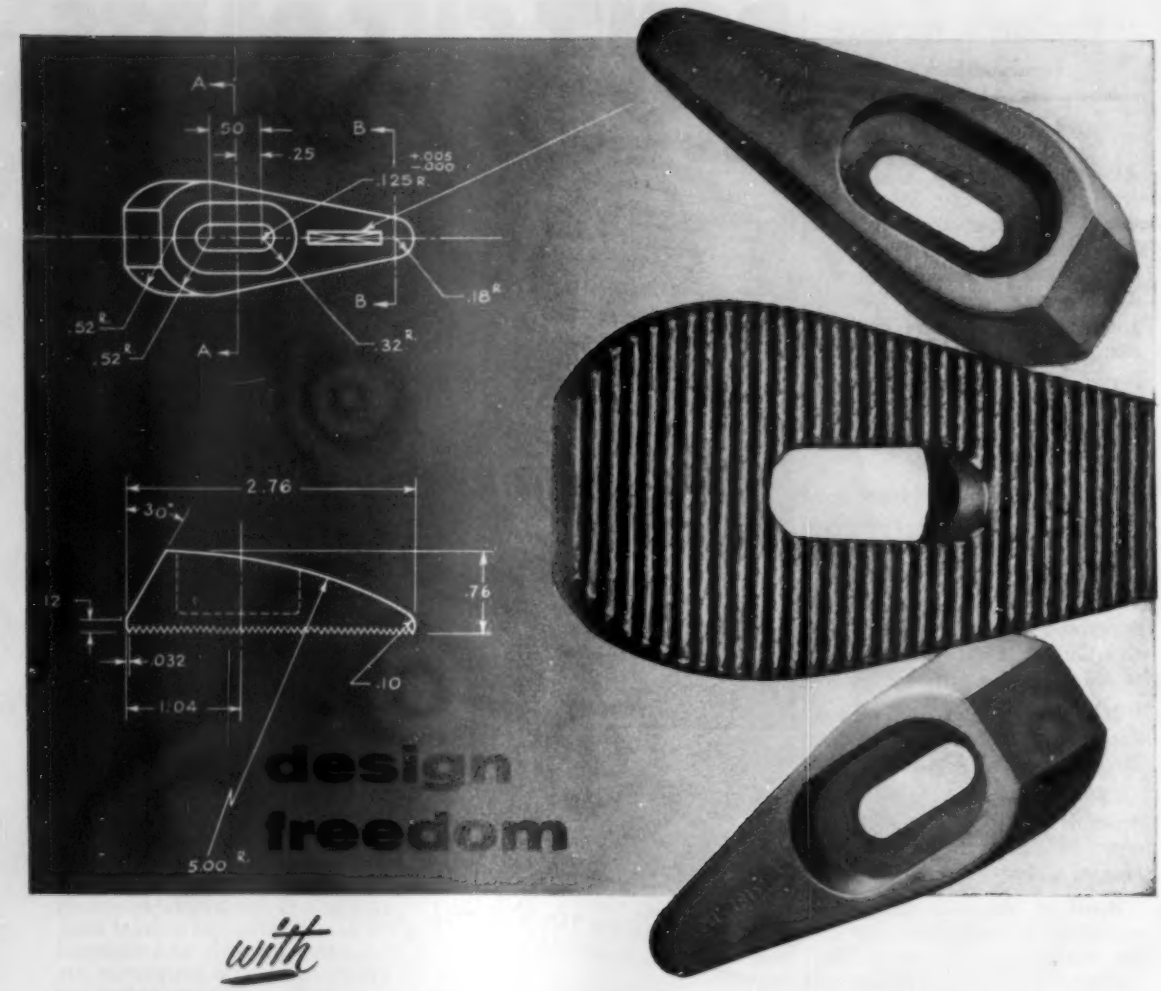

with

CRUCIBLE ACCUMET PRECISION INVESTMENT CASTINGS...

Here's another good example of how Accumet Precision Investment Castings help put an end to design problems.

To machine the curved and tapered surfaces, elongated hole and counterbore, and serrations on this AISI 4140 alloy steel aircraft part, would have been too costly to be practical. But the parts were quickly and economically produced by investment casting.

More and more parts are being *designed* specifically for the investment casting process. And there are good reasons why. Crucible Accumet Precision Castings allow the greatest freedom of design. Intricately shaped parts can be made of any grade of steel, including high-alloys, in large quantities and at low cost.

It will pay you to let your local Crucible representative give you the whole story of how Accumet Precision Castings can help you produce a better product at lower cost.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ACCUMET PRECISION CASTINGS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

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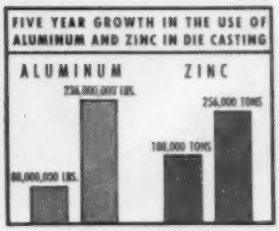
DIE CASTING REPORT ..... the first of a series

Constant Spot Checking by Lab "Detectives" Assures Sound Zinc Die Castings for Industry

Uniformity guaranteed by periodic analysis of production die casting runs

The high strength, soundness and uniformity of today's die-cast zinc parts can be attributed to the continuous and vigorous efforts of the industry itself, through the American Die-Casting Institute, to establish an alloy standards unification plan.

To assure maintenance of alloy purity, the industry sponsored the Certified Zinc Alloy plan, which put "teeth" into the industry's enforcement of standards. Recognition of improvement in alloy control is shown in steadily increasing annual production of zinc die-castings in the past five years. As the accompanying chart shows, the use of both aluminum and zinc have risen to new heights.

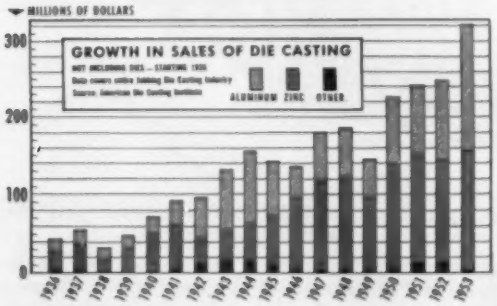


Die-casters, licensed under the C-Z plan, must submit sample castings, regularly, to independent laboratories. In addition, C-Z lab representatives periodically visit each licensed plant, *without previous warning or notice*, to select samples from die-casting machines in operation. These "detectives" then determine by spectrographic analysis whether each sample conforms to the strict chemical composition limits required in ASTM specifications. Thus, industry maintains its own "police force" for the benefit of die-cast buyers.

When you are considering the use of zinc die-castings, it is wise to check the suppliers; wiser still to deal with those who use the C-Z seal.

WHAT this seal means to the buyer of Zinc Die-Castings

1. That high purity metal is used
2. That adequate chemical control is maintained
3. Positive identification of castings produced under the plan
4. An easy way of identifying die casters who conform to acceptable chemical control requirements in processing
5. Assurance of the mechanical and physical properties inherent in zinc die castings

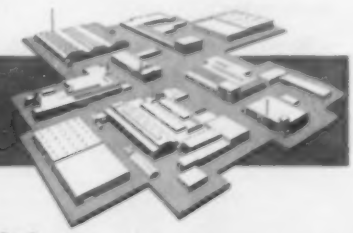


AMERICAN DIE CASTING INSTITUTE

97 members represent $400 Million Industry

Now in its 26th year, this national Institute was formed to raise the standards of efficiency and improve practices in the industry. It recently organized the Die-Casting Research Foundation to further the development of new die materials and casting procedures in non-ferrous and eventually the ferrous metals. A new 16-mm color film is now available which describes the die-casting process, how to improve product design and reduce costs. Showing may be arranged by writing to us or any member of the Institute.

It will pay you to put die-casting into your product or component part planning. "Die-Castings...Unlimited" is a new 24-page brochure which details Precision's integrated services. If you would like a copy, address your inquiry to PRECISION CASTINGS CO., INC., 195 Chapel St., Fayetteville, N. Y.



PRECISION CASTINGS CO., INC.

World's largest independent producer: aluminum, magnesium and zinc die castings

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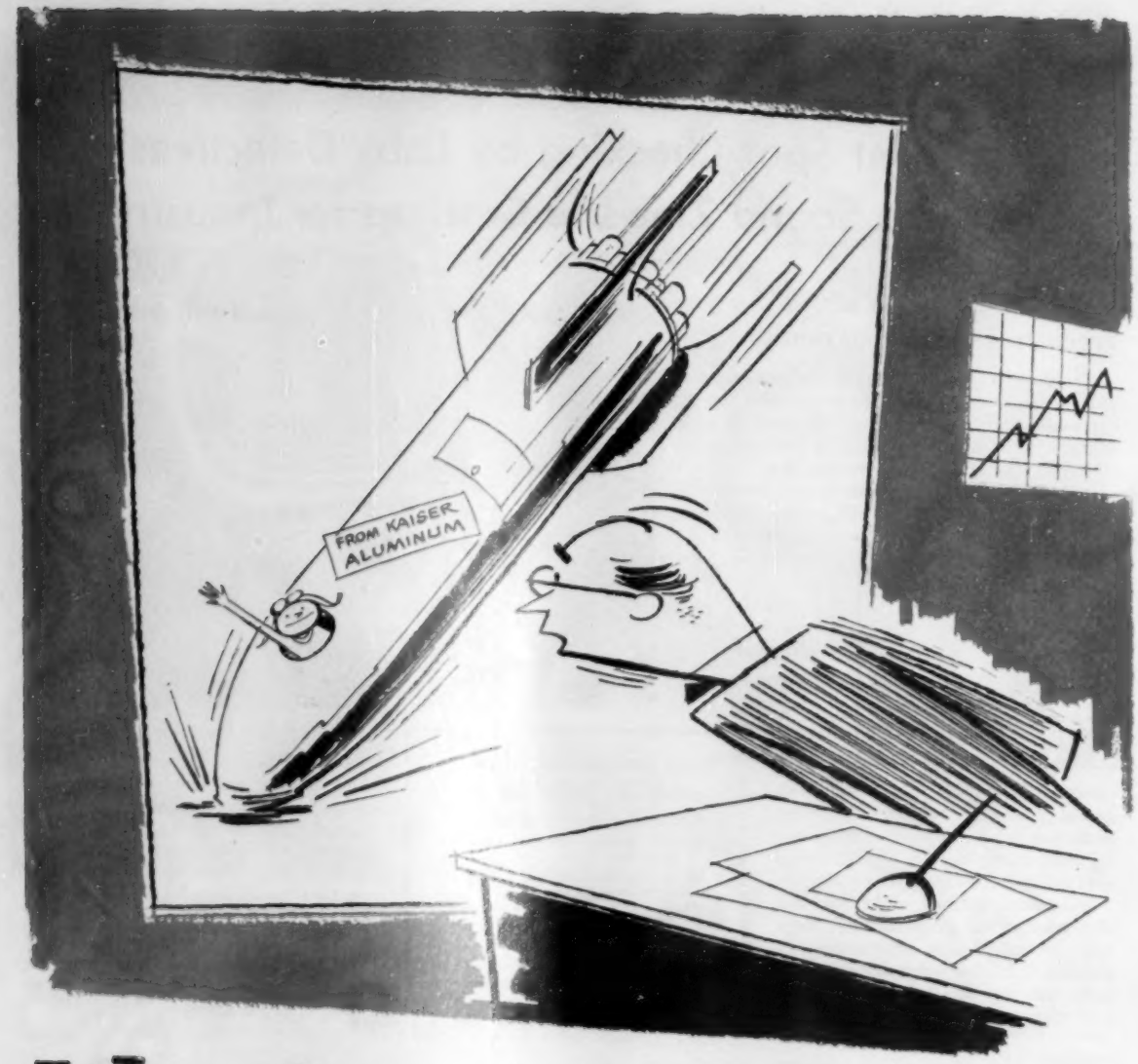

Want faster delivery?

HERE'S one important reason why users of pig, ingot and billet rely on Kaiser Aluminum:

Faster service and delivery on orders from our conveniently located plants at Newark, Ohio; Chalmette, Louisiana; Halethorpe, Maryland; Mead and Tacoma, Washington.

In addition, Kaiser Aluminum is a dependable source of supply because we are an integrated producer. We produce pig, ingot and billet to all standard specifications or to special customer specifications.

Our outstanding engineering service includes design assistance and other technical advice. For prompt personal service, contact the Kaiser Aluminum sales office listed in your telephone directory.

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Kaiser Aluminum

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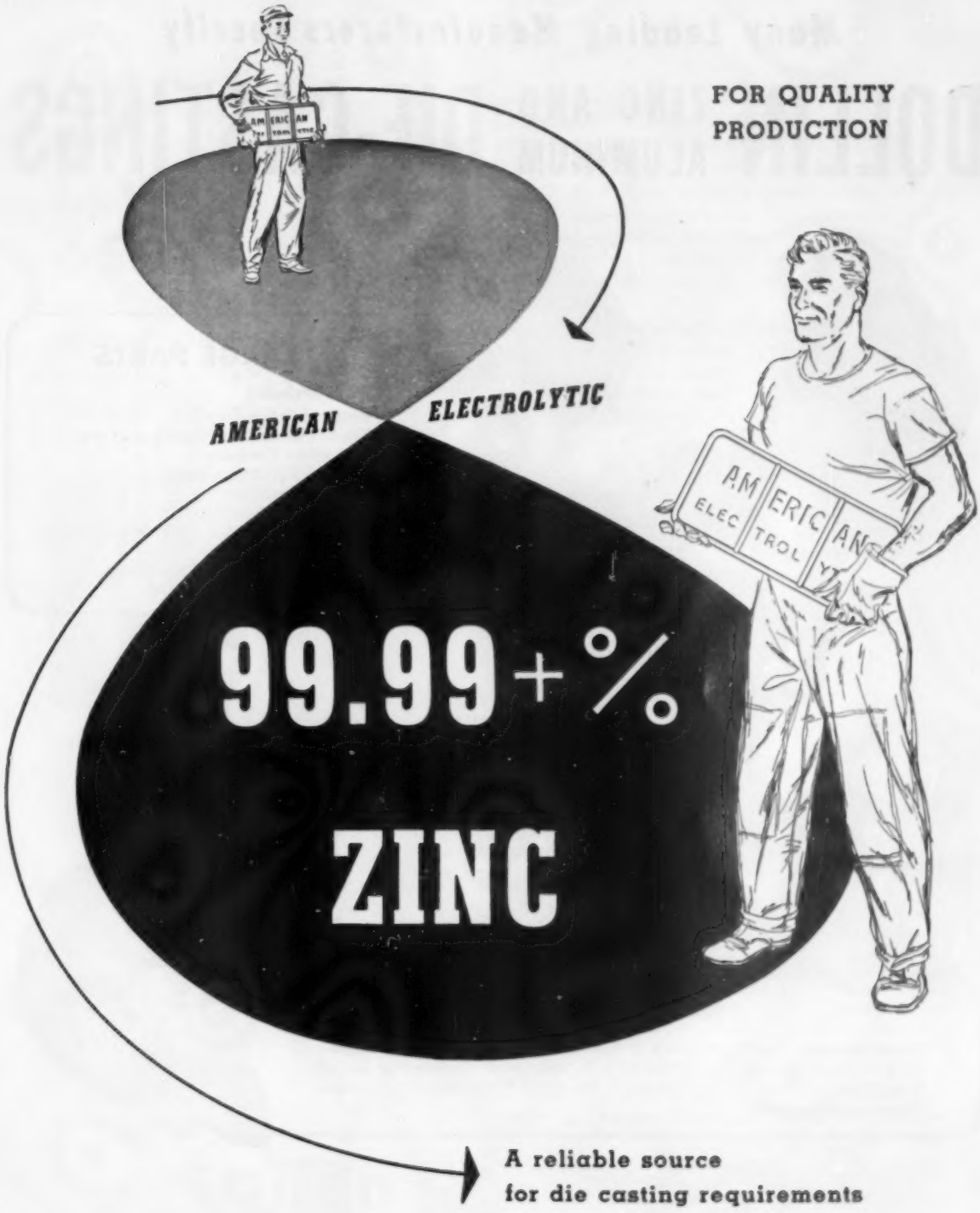

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FOR PRECISION
DIE-CASTING . . .
THE IMPROVED

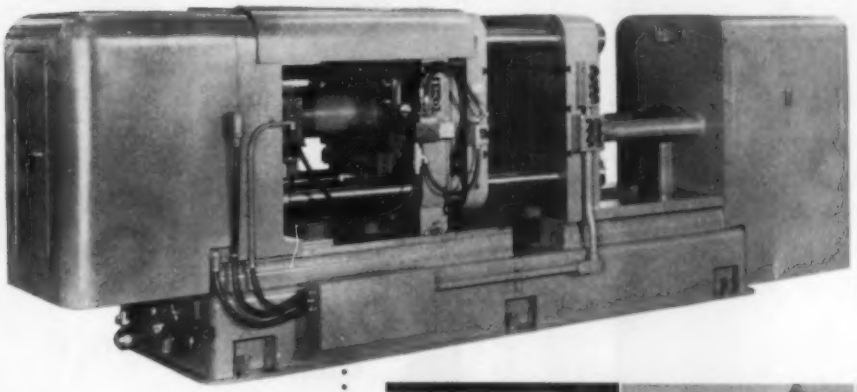
LEWIS 650-B

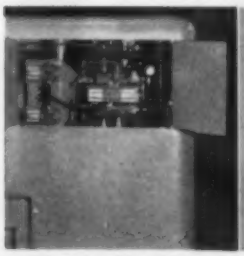
GIVES YOU FASTER
PRODUCTION . . .
MINIMUM SCRAP . . .
GREATER PROFIT

New and improved controls . . . a re-designed injection system . . . the exclusive "HYDRA-LOCK" clamp . . . and other outstanding features make this LEWIS die-forge casting machine tops in its trade.

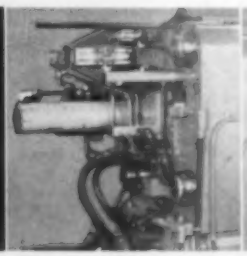
Versatile Model 650-B produces accurate pressure-tight light-metal castings with minimum scrap. All operations, except actual pouring, are either automatic or pushbutton controlled. Maximum safety is assured by the 650-ton clamping pressure and positive locking action of the "HYDRA-LOCK" clamp.

With eight years of research and pilot tests behind it, the LEWIS 650-B has been further refined . . . through "perfectionist" engineering and actual production operations . . . until it is the most advanced design available to the die-casting industry today.

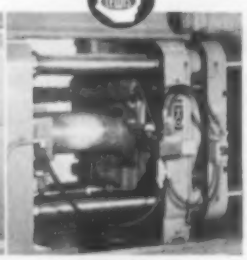




Variable two-stage injection system develops pressures up to 100,000 pounds to assure dense flawless castings. Access doors in detachable hood permit rapid adjustment.



All valves and cylinders for moving platen, clamp mechanism and sliding-block locking device are mounted in one location for fast, easy adjustment and maintenance.



"HYDRA-LOCK", a new clamp principle exclusive in LEWIS machines, utilizes a large-diameter short-stroke hydraulic cylinder to develop final closing and locking pressures up to 650 tons.

Write today for Bulletin 103 for complete details.

LEWIS

THE LEWIS WELDING & ENGINEERING CORPORATION
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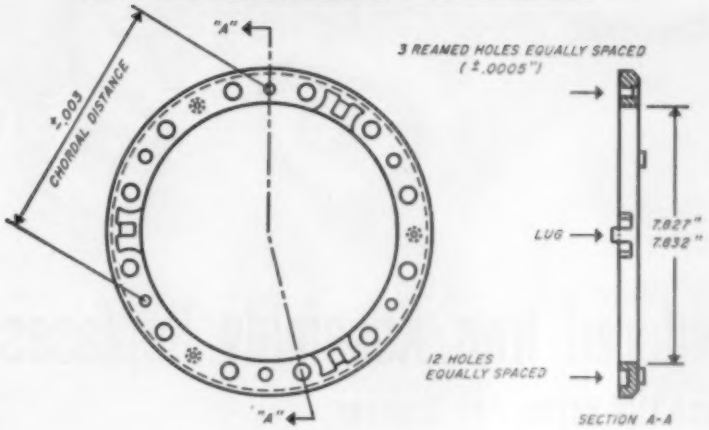
and others . . .

Such patronage must be deserved

THE NEW ENGLAND DIE CASTING CO.

445 Front Ave, West Haven, Conn. • P. O. Box 1281 New Haven, Conn.

BLIND HOLES cored around the underside of this die cast zinc clutch ring are examples of the elimination of expensive machining by die casting.



Plus or Minus .0025 In 7½ Inches

EARTH MOVING equipment, like this heavy diesel tractor, takes a page from the autobuilders' notebook, making use of die cast parts for cost cutting.

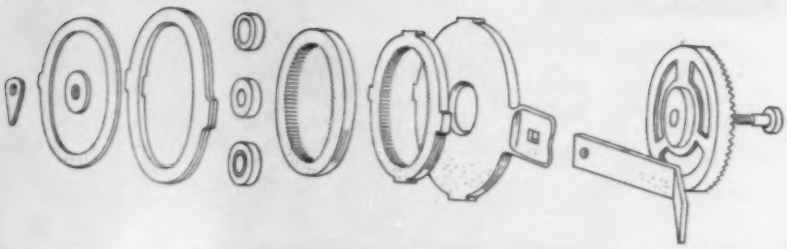
MANUFACTURING costs of a tractor clutch ring are held to a minimum at Allis-Chalmers Manufacturing Co., Milwaukee, Wisconsin through specification of zinc die casting. Satisfactory tolerances are held in the 9½" diameter ring without machining, except for three holes which must be reamed to hold diameter within .001. Close tolerances are possible because of the relatively low melting point of zinc alloy.

The clutch follower ring is used in the HD-20 diesel-powered crawler tractor, left. The inside diameter, which exceeds 7½", is held within limits of ±.0025 and the bolt circle is held concentric with both ID and OD within .010 total indicator reading. Three reamed holes (the only machining required) are equally spaced within .006 on their 7½-inch chordal distance, above. Flatness of the ring is held within .010.

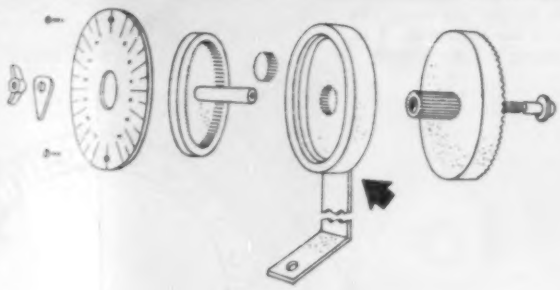
The follower ring illustrates how substantial cost savings can be realized through elimination of expensive machining operations. If accomplished by machining, formation of the three projecting lugs would require removal and scrap loss of at least ¼" of stock from the face of each ring; development of the depressions beside the lugs would be time-consuming because of the intricate contours involved; and formation of the 12 flat-bottom, blind holes in the ring face within specified tolerances would be difficult to achieve. Die casting eliminates such machining.

The ring is cast by Milwaukee Die Casting Co. of A.S.T.M. #23 zinc alloy in a hydraulic plunger type hot chamber die casting machine. The castings are produced in a single-cavity die at the rate of approximately 700 in an 8-hour day.

FROM CAST IRON



TO POWDERED IRON . . .



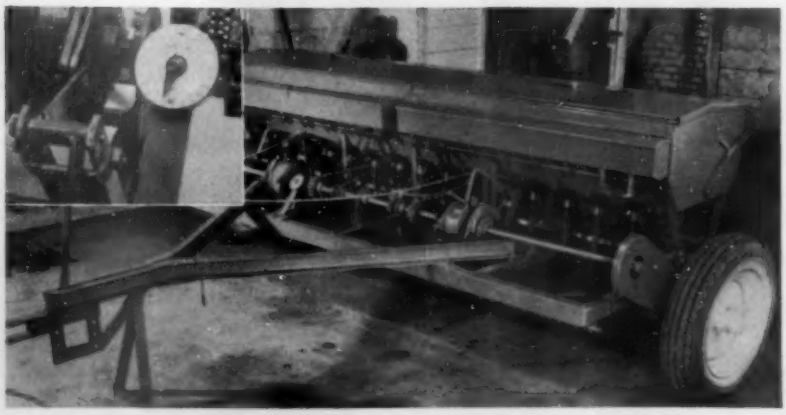
Powdered Iron Assembly Replaces Cast Iron

Because It's Better And Cheaper

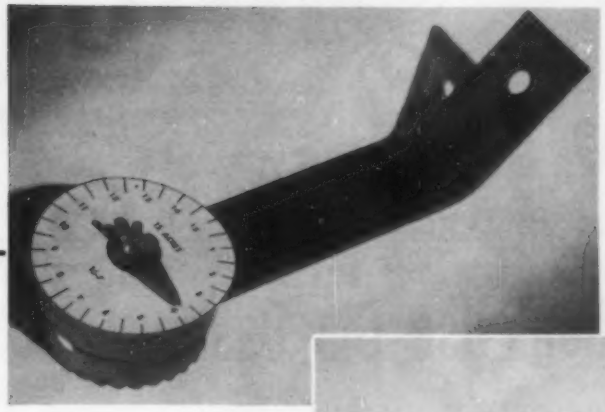
By **HARRY E. MESNARD,** Design Engineer
Cockshutt Farm Equipment, Inc.

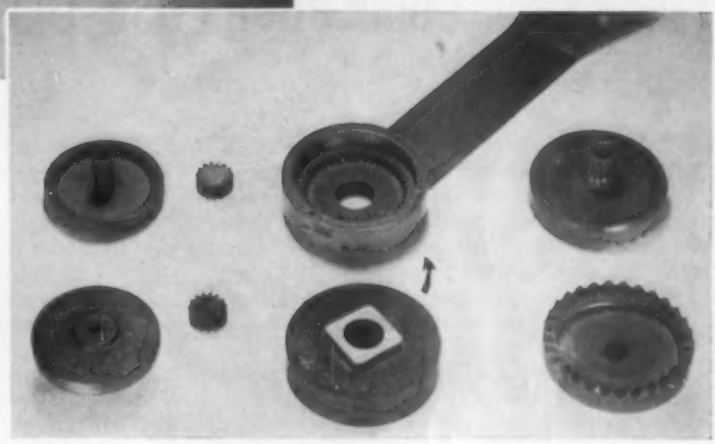
ON the Model 110 grain drill, manufactured by Cockshutt Farm Equipment, Inc., a simple device driven by the main drive shaft of the drill, tells the operator at a glance just how many acres have been seeded.

It would seem that such a device, called a "surveyor," would be simple to make to give the desired accuracy. After all, one need only determine the speed reduction (183.3 to 1), build it into the machine, and the problem is solved.



STURDIER, more compact, device (inset) has been developed to count seeded acreage on this grain drill because powdered iron components have taken the place of assembled iron castings.





ONLY FOUR powdered iron pieces are used in place of the nine cast iron ones formerly used. The complete "surveyor" is shown above, and the powdered iron components are shown at right in top and bottom views.

Some serious problems were involved in the design:

- It must be very expensive,
- It must withstand considerable vibration and jarring due to the rough land over which the grain drill operates,
- It must run for long periods with little or no lubrication in extremely dusty and abrasive atmospheres,
- It must be reasonably accurate, which means that no slippage and little wear can be tolerated.

The modern surveyor above left, is built entirely of iron powder parts made by the Powdercraft Corp., except for the mounting bracket, bolt and dial.

The main operating units of the instrument are the four iron compacts shown above right and, from this illustration, it is apparent that these four parts could not be made as iron castings and then machined. Yet, as this unit was originally designed, it was a combination of iron castings and machined parts.

The exploded drawings show the marked difference between the older unit with nine main parts and the new powdered iron one with four main parts.

Tolerances for this unit are not particularly close. Most dimensions are held to a total variation of 0.004. Gear teeth are 20 deg. involutes, held to a depth tolerance of ± 0.0005. On external gears, the base diameter, pitch diameter and outside diameters are held to $+0.000\ -0.004$ while on the internal gears, the reverse tolerances are held. Structurally, the parts conform to ASTM Specification B-202-51T, type 2, class B and are oil impregnated.

When it was made of iron castings, the mounting of the surveyor on the drill, presented another problem. A part of the bracket was incorporated as one of the castings. To this was bolted an extension which was, in turn, fastened to the machine. With the powdered iron part, a single bracket arm is formed from hot rolled steel and welded to the underside of the cup shaped part indicated by arrows. Through the advantages of powder metallurgy, it became possible to form a square boss on the underside of this piece which fits nicely into a square hole punched in the bracket. In this manner, rotation of the part is prevented and the entire assembly properly positioned.

Although this material is not fully dense (about 70 to 75 percent of theoretical density) there has

Continued on page 74

DIE CASTINGS

WHEN YOU NEED large numbers of identical parts for high quantity production, then die castings will give you the same economies that they give to the builders of business machines. Here are some of the reasons.

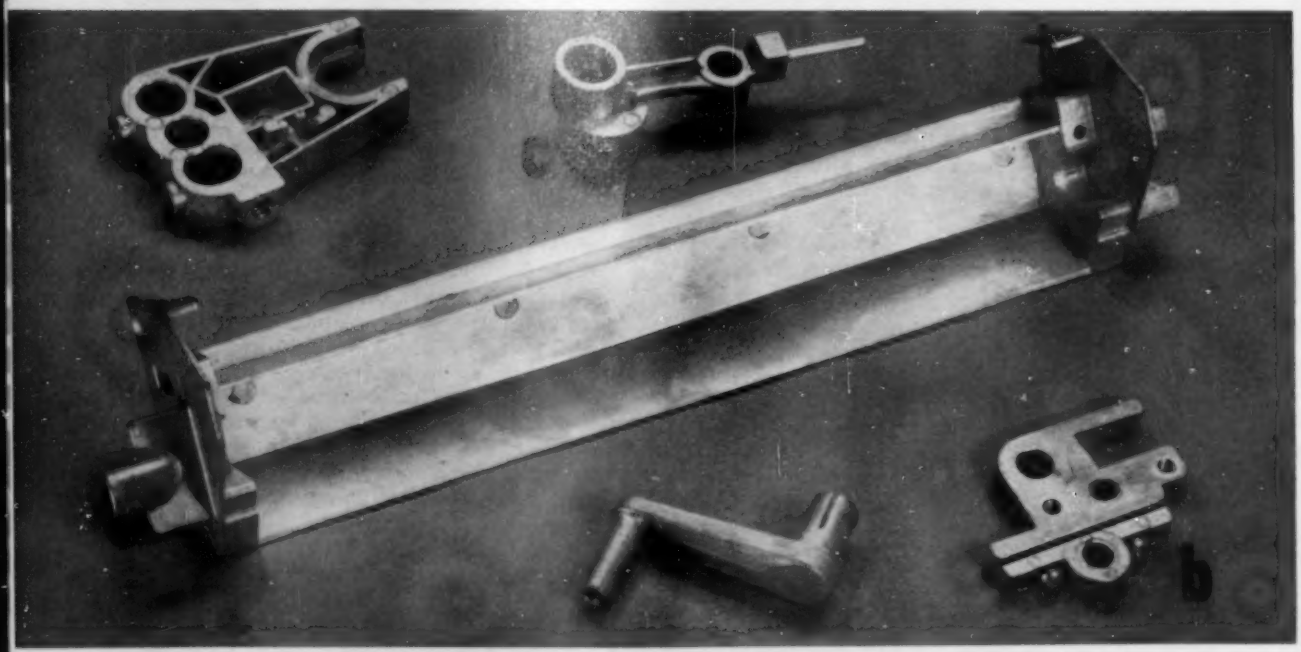
For Exact Duplication: Use Die Castings

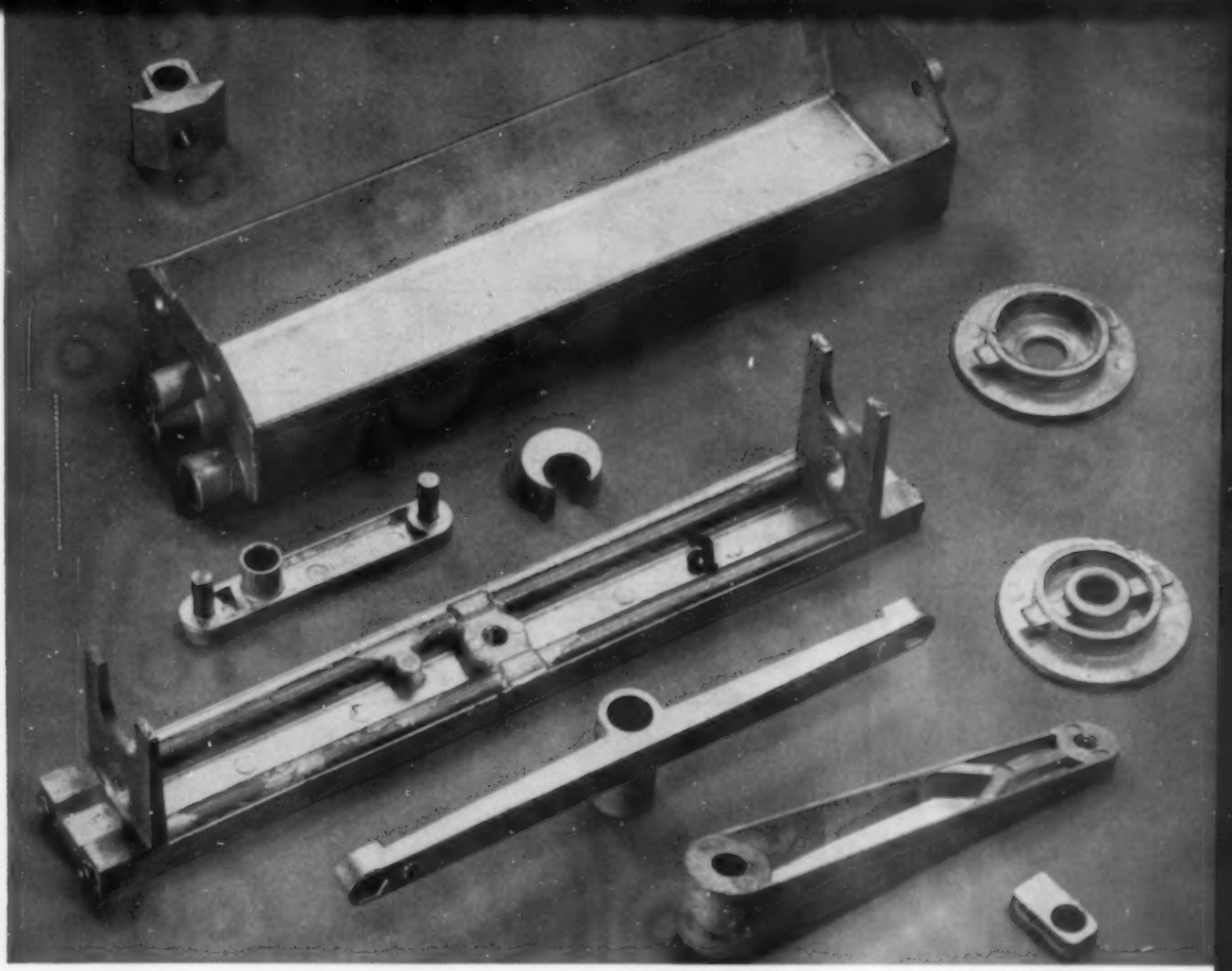
MODERN office machines, such as typewriters, adding and calculating machines, duplicating machines and many others, are being mass produced at relatively low costs only because many of the component parts can be and are being die cast in aluminum, zinc and magnesium. Were it not for the die casting process, the machines would be heavier, bulkier, more costly.

The 12 models of spirit duplicating machines made by Rex-O-Graph, Inc., of Milwaukee, Wis., use die castings wherever sound engineering design and manufacturing economy dictate. In some cases, the parts were originally designed as die castings. In other cases, the change to a die cast part was from a sand casting or a fully machined part.

A few of the many die castings currently being used by Rex-O-Graph, Inc. are shown in the accompanying illustrations. All of these are zinc and all of them are fabricated by Advance Tool & Die Casting Co.

While lowered manufacturing cost of the finished part, when ready for assembly, is the principal reason for the use of die castings, it is interesting to examine the illustrated parts to determine how this saving is accomplished.





Five Features That Save Money

1. Nearly all of the holes needed for any purpose can be and are cored. This not only saves the drilling operation, but expensive jigs and fixtures to hold the part during drilling are not needed.

2. The next general saving that can be seen in all of the parts is that surfaces which must be held in relatively precise angular relationship to each other can be held as close as needed in the casting operation. Thus, precise machining operations are avoided.

3. The use of cast-in inserts to cut costs, include the steel inserts on the impression roller cage (a), the oil impregnated bushing in the feed roller bearing block (b) and the pins on the pusher level. On all of these parts, the inserts are more firmly locked in place and machining to an interference fit is avoided.

4. Another obvious saving is in surface finishing costs. If sand castings were used, an overall surfacing operation would be necessary. With zinc die castings, however, all that is required is to remove any residual parting line marks and then apply a coat of enamel. In the few cases where the finish is a chromium plate instead of enamel, the amount of work required to prepare the die cast part is far less than would be true of sand castings.

5. The use of a single die casting instead of an assembly of two or more parts is another saving. The register arm (c) is an example of such a part that was formerly two pieces, machined from wrought stock, and held together with machine screws. The new die cast assembly is both stronger and less costly.

These and other production savings are reasons Rex-O-Graph, Inc. uses zinc die castings and is continually studying design changes that will enable them to convert more and more parts to either zinc or aluminum die castings.

TYPICAL PART	PREVIOUS METHOD	ANNUAL QUANTITY	SAVING IN TOOL COST	SAVING IN PIECE COST
Push button stem (Figure 1)	Four-piece brazed & riveted assembly	1000	$500	65%
Peripheral cams (Figure 2)	Machined & brazed	150	$200	50%
Multiple cam unit (Figure 5)	Five stampings brazed & riveted	500	$500	60%
Key cylinder (Figure 6)	Machined from bar	500	$350	60%
Segment gear (Figure 7)	Machined from 1/4" plate	150	$100	50%

INVESTMENT CASTINGS

Tool Write-Off Over Short Runs means savings on specialized jobs

By M. J. SCHWARTZ,
Chief Manufacturing Engineer
Taller & Company, Inc.

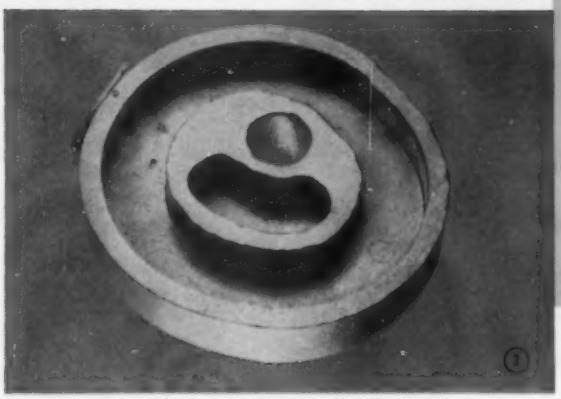
AMONG the products engineered and manufactured by Taller & Cooper, Inc., is toll collection equipment used throughout the country on the growing network of super-highways.

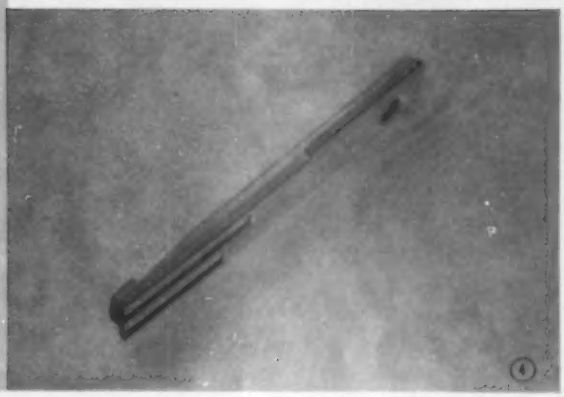
Despite the tremendous highway building program now in progress, the number of individual machines used on toll equipment is rather limited — hardly a mass production item.

To build into this equipment all of the necessary functions, some of the individual pieces must, of necessity, become extremely complex. Were it not for the investment casting process, the cost of producing these pieces would, in many cases, be several times the present cost and would represent an appreciable increase in final cost of the various pieces of equipment.

The investment cast pieces described here are not the only ones made by this process for toll equipment, but are considered representative. Castings shown in Figures 1-6 are made by The Investment Casting Co., Springfield, N. J., while the one in Figure 7 is by Jelrus Precision Casting Co., Brooklyn, N. Y.

CASTINGS LIKE THESE . . . .





1. No Fatigue Failure Originally made as a brazed and riveted assembly of four pieces, this push button stem is now a single investment casting in 1095 steel. Not only was the original piece costly, but the switch actuating ears were formed by bending relatively thin gauge steel into a "U" which usually failed from fatigue after about a year of service. Further, for economy of manufacture, only the ratchet was then made of 1095 steel.

By conversion to an investment casting, some 25 machine and assembly operations have been eliminated. A stronger piece is secured which has never failed in service. A saving of some $500 in tooling costs was achieved on a production of about 1000 pieces per year and an overall per piece saving of 65 percent has been shown.

On the investment cast part, the stem must be turned and threaded, the teeth on the short rack induction hardened and the entire piece cadmium plated.

2. Replaces Brazing These investment cast cams now replace the former two-piece brazed assemblies. As first made, one stamped part and one screw machine part were assembled by brazing. In addition to the screw machine tooling, both blanking and shaving dies were needed, the bore was reamed, the set-screw hole drilled and tapped.

By conversion to investment castings in either 1020 or 8620 steel, (the material choice is at the option of the foundry), all machining operations, except to ream the bore and drill and tap the screw hole, are eliminated. The cam surface is still carburized and induction hardened to about 60 Rc.

On a production of about 150 parts of each design per year, there has been a cost saving of over 50 percent per piece as well as an initial saving in tooling of about $200 per cam design.

3. Internal Cam Because of the complex shape of this internal cam and the expensive machining operation it represented, the part was originally designed and made as an investment casting. It is used in the as-cast condition except for reaming the bore and drilling a pin hole in the hub on the under side. The part is cast in 1020 steel, carburized and fully hardened, except for the hub, to 60 Rc. Production is about 150 pieces per year.

4. Replaces Sand Casting Each toll gate operator is furnished with an identification key which, when inserted into the machine, sets up individual collector's

Continued on page 73

Shapes That Are Difficult To Machine Into A Die Cavity? Hobs That Are Too Intricate To Drive Into Steel? The Answer May Be . . .

Hobbed Beryllium Copper Die Casting Cavities

By ALBERT M. SANDERS
Allen-Stevens Corp.

SHAPE OF THESE two zinc die castings would be very difficult to machine into a die cavity, so . . .

THEY HAVE BEEN HOBBED into beryllium copper cavities which follow the shape of the hobs exactly.

As a means of reducing tooling costs for producing die castings, many unconventional methods of mold construction have been tried. Among them is the use of beryllium copper mold cavities* which, for certain types of castings, offer the most satisfactory and economical method of producing cavities.

Although beryllium copper mold cavities have their limitations, they have proved to be highly successful in many instances. Two such successful uses of beryllium copper mold cavities from the experience of Allen-Stevens Corp. are described here in order to point out the advantages of this tooling. Also included is a note of caution concerning the hazard of erosion in the cavity, and suggestions for overcoming this problem.

Consider the case of the two zinc alloy die castings illustrated. These parts are precision lock components and a close examination reveals that they are quite intricate in shape. The projecting lugs are actually cam surfaces and follow a very carefully outlined three-dimensional curve.

The question which presented itself was: how could the cavity for die casting these parts be made without incurring exorbitant tooling expense?

What kind of cutting tool, for example, could get down into the small hole which would be required in the cavity and shape the precise surface of irregular contours and square corners?

Would it be necessary to make a built-up cavity, that is to say, of several pieces of metal, each piece appropriately machined and then the entire group assembled in order to obtain the appropriate shape? This would be extremely expensive.

The only solution seemed to be the use of hobbed rather than machined cavities.

In hobbing, a hard steel male pattern — or hob, as it is called — of the part to be cast is pressed, under tremendous pressure, into soft steel to form a female die cavity. This practice is followed when, as here, it is more feasible to machine a male duplicate of a part rather than to cut a female impression. But once again the problem of excessive costs came up since on the lock parts illustrated, the hobs required would be of a symmetrical contour, which, experience has shown, frequently become distorted or break when pressed into steel.

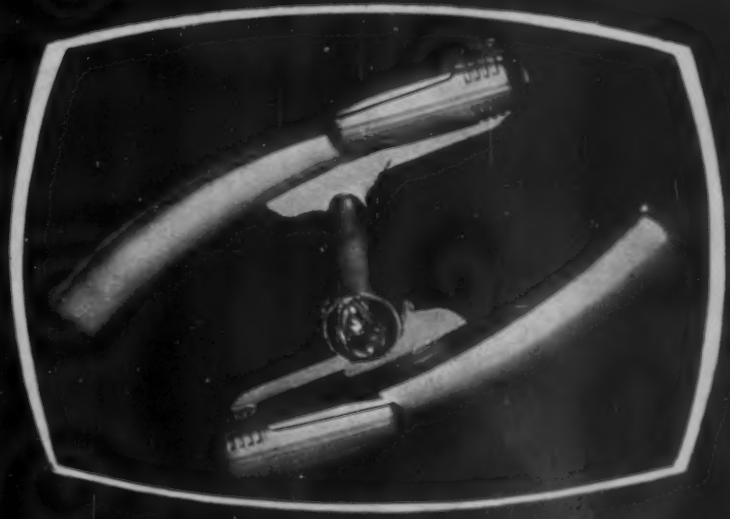
The use of beryllium copper was the solution to the problem of how to use hobs without breaking several before the necessary cavities were obtained. The usual hardened

Continued on page 77

*Editor's Note: In November 1954 PMM offered a report on the use of beryllium copper in precision castings. Attention was given to this alloy as a mold material for zinc die casting. Presented here is a description of two successful case histories in which the pro's and con's of beryllium copper mold cavities for zinc die casting are discussed.

For more information circle No. 2 on the Reader Service Card

telling the story of dag dispersions



Compare Your Present Die Lubricant With 'dag' Colloidal Graphite

Your Present Die Lubricant	'dag' Colloidal Graphite
1. Is it difficult to apply?	1. Easily and quickly sprayed on, painted on, or applied by dipping.
2. Does it break down at high temperatures?	2. Totally unaffected by heat up to 750°F. Forms tenacious *dry lubricating film* on die surfaces.
3. Does it fail to prevent *all* die sticking?	3. *Prevents all sticking in the die.*
4. Does it present production problems?	4. Improves product finish, reduces carbon build-up in die impressions. Can also lubricate ejector pins and plungers... prevents sticking and jamming.

More advantages of 'dag' colloidal graphite dispersions are explained in Reprint DC and Bulletin No. 426-B

Dispersions of molybdenum disulfide are available in various carriers.

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... Also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND

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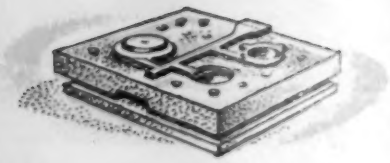
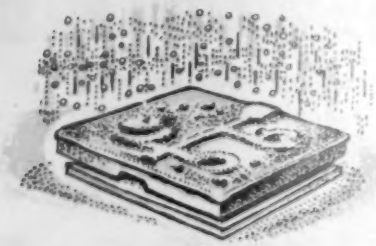
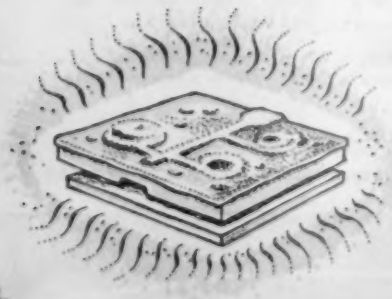
SHELL MOLD CASTING



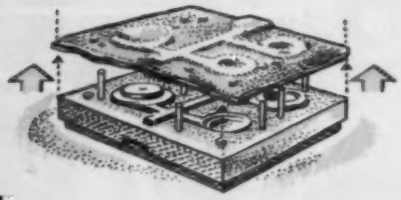
1.
METAL PATTERN is required for shell molding. Surfaces must be smoother, dimensions closer, than those used for sand casting.



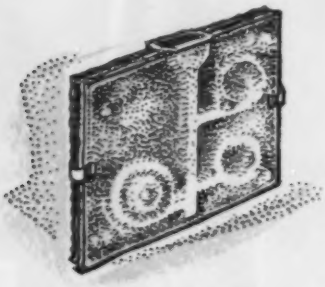
2.
SAND AND RESIN mixture is dumped freely onto the heated metal pattern as the first step in making the shells.



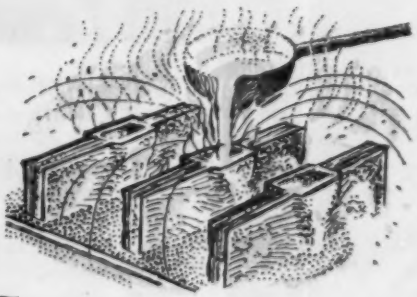
3.
HEAT IS APPLIED to cure the resin-sand mixture and make rigid, firm, easily-handled shell. Cope and drag sections give two mold halves.



4.
CURED MOLD is ejected from the pattern plate and is ready to be assembled for casting, or can be stored for long periods without deterioration.



5.
READY FOR CASTING, the two halves are assembled and fastened either with adhesives, clips, bolts or similar methods.



6.
DURING CASTING the shell molds are firmly supported to prevent distortion. Use of abrasive shot or sand for back-up is common.

7.
GATE OF CASTINGS emerges from the expendable resin-sand shells. Slow, expensive shakeout needed by sand castings is avoided.

One of a series of basic facts about the

pmm *processes for designers and buyers*

The Shell Mold Casting Process

WHAT IT IS The shell mold casting process is actually a refinement of green sand mold casting. The difference, and the refinement, lies in the mold that is used.

With a mixture of about 5 percent phenol-formaldehyde synthetic resin and the balance very fine foundry sand, it is possible to make a mold with thin walls that reproduces quite exactly the detail of the pattern. Because of this good reproduction of detail, dimensions can be held closer than in green sand mold casting and a superior surface finish is achieved.

In practice, a metal match plate, often of aluminum, is made in the same manner as for normal green sand. The dimensional accuracy of the pattern, the attention to detail, and the surface finish all are better for shell molds. Wood patterns are impractical because the patterns are heated during the process.

The pattern is heated sufficiently so that when the resin-sand mixture is poured onto it the resin will start to set. A large excess of resin-sand mix is dumped onto the hot plate and after a few minutes the excess is poured off. Under proper control a layer about ¼ inch thick adheres to the pattern. This residual resin-sand mix still on the pattern plate, is placed in an oven and the plastic cured so that a hard, rigid piece is formed. After removal from the oven the plastic-bonded sand mold is stripped from the pattern and the process is ready to repeat.

Complete molds are made in two halves, with any cores made separately and positioned in core prints. Mating halves are put together and fastened with clips, bolts, adhesives or other fastening systems. Firm attachment of the two halves is essential to minimize dimensional variation across the parting line; consequently, the foundry spends a great deal of thought and effort in selecting the method of fastening the shell halves together.

Gates, risers and vents are incorporated into the pattern so that they are formed as an integral part of the shell.

Prior to pouring the metal, the assembled molds are set up, either in groups held together with clamps, in boxes where the molds are backed with sand or shot, or some other arrangement that give firm, unyielding support during pouring.

Actual pouring of the metal varies only slightly from conventional sand casting practice. The metal can be poured usually at lower temperature, which then permits faster cooling and a shorter casting cycle.

WHEN TO USE IT Shell molding seems to have its greatest advantage for the buyer of castings when large numbers of duplicate pieces are to be made. Some authorities arbitrarily suggest 5,000 as a realistic minimum. This stems from the fact that pattern and equipment costs are higher than for sand casting.

However, there have been many exceptions to this rule-of-thumb comparison, and in unusual cases, shell mold castings have been found to amortize tooling costs and show a saving over heavily-machined sand castings after 50 or 100 pieces.

Physical Properties

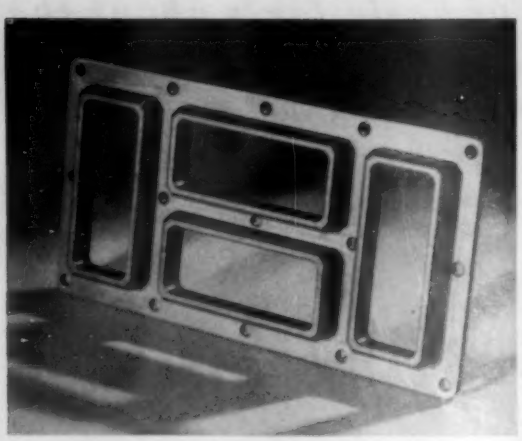
Design Considerations

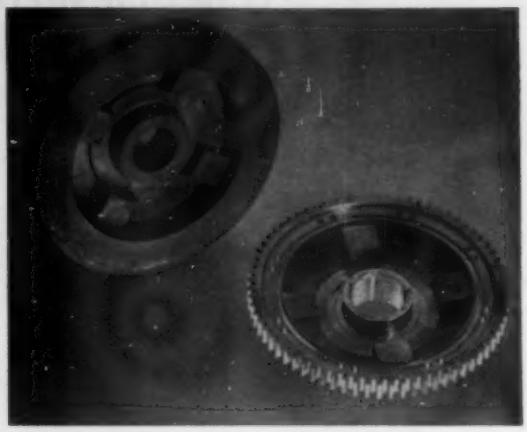
Metals Used

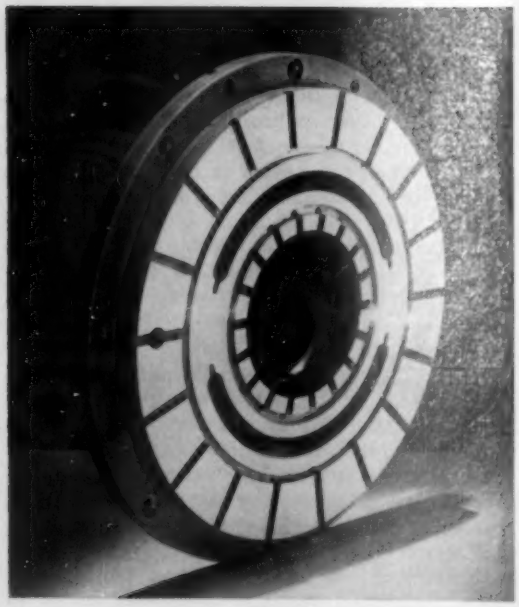
Typical Applications

Same Advantages

"Porosity is almost eliminated as a source of casting rejects..."







WHETHER HEAVILY MACHINED, such as the gear blank above right, or used essentially as-cast, shell mold castings offer sound internal structure that cuts down the percentage of rejects. Here are four typical shell castings that require dense, non-porous metal.

Shell Mold Casting — Cont.

The comparison is not always to be made with sand casting . . . a shell mold casting should also be considered in comparison with forgings or other high-tooling cost processes. In these instances, shell mold casting may actually have lower initial cost.

In addition to the question of first-costs, the buyer of castings should consider piece costs, amount of machining or other surface finishing, casting quality, size, alloy, and design features that may be desired.

Piece costs: One assumes that higher priced tooling, use of resins, the introduction of a heat curing cycle, all tend to raise the price of the casting. While these are certainly true, the other side of the picture shows many economies such as the much higher percentage of sound castings, the faster casting cycle, the smaller amount of casting cleanup, the reduced loss of metal, the lighter wall sections that are possible, etc.

Finishing costs: No cost picture is complete without comparing the steps between the emergence of the casting from its mold and its assembly into a product. Where quality surfaces are

needed, close dimensions, or other features that call for machining, grinding, polishing or other secondary operations, the advantage is likely to be heavily on the side of the shell mold casting.

To say that shell mold casting is "less expensive" or "better than" some other type of casting or fabricated piece is to oversimplify. Comparisons can only be made in individual instances, weighing all of the factors of quantity, tool cost, piece cost, secondary processing, quality, etc., but in general, one might suggest the outline of a typical shell mold casting as being one in which:

1. Quantities are relatively high,
2. Special, difficult-to-machine contours such as cams have to be formed with reasonable accuracy,
3. Dimensions are required to be somewhat closer than can easily be produced by sand casting, forging, etc.,
4. Surface smoothness and internal soundness are important,
5. Size is small to medium, with a likelihood of having a relatively low weight-to-volume ratio,
6. Almost any castable alloy may be specified (but certain problems are connected with the low carbon steels and the magnesium alloys).

Casting quality: Where difficulties have been encountered in sand castings due to the discovery of internal porosity and blowholes after expensive machine work has been applied, it will often pay to convert to a shell mold casting, even when there is no apparent cost advantage. In many instances, the number of rejects due to internal defects has been cut almost to zero. Not only does this save on individual castings, but also it eliminates the waste of time and labor in machining before the defects are discovered.

From a metallurgical point of view, the high permeability of the resin-bonded shells permits free escape of gases and, consequently, castings which are certainly free of gross gas inclusions or blowholes, and also, to a large extent, free of minor porosity.

Size: Size of castings is limited by the available shell-making equipment, but most commercial foundries have an upper limit on weight of castings between 10 and 20 pounds. Obviously, the problems and costs increase as size of castings increase . . . large castings require heavier shells to resist the increased pressure during casting, they are more difficult to hold accurately, handling of equipment is slower. This tends to gravitate away from the shell molding process in the larger size range; however, some castings between 100 and 200 pounds have been reported and, in special cases, shell molding may be the preferred method.

Which Will It Be . . . Shell Mold or Sand Cast?

	Shell	Sand
Dimensional Accuracy	Good	Poor
Surface Quality	Good	Poor
Reproduction of Detail	Good	Poor
Properties As Cast	Good	Fair
Defective Castings	Low	Medium
Pattern Costs	High	Low
Sand Costs	High	Low
Mold Storability	Good	Poor
Production Cost of Mold	Low	High
Metal Waste Per Casting	Low	High
Lead Time on Production	Good	Medium
Cost of Foundry Equipment	High	Low
Alloy Choice	Most	All
Finishing Required on Castings	Low	High
Intricacy of Coring	Medium	Good
Minimum Section	Thin	Thick
Percent of Usable Castings	High	Medium

Alloy: As mentioned above, choice of alloy is very wide, including most ferrous and non-ferrous alloys. As in sand casting, some foundries specialize in one or another group of alloys and have solved the problems inherent in those metals. By-and-large, certain foundries can be found with experience, regardless of one's choice of alloys.

Design features: Probably sand castings offer greater complexity of shape than do shell mold castings, but on the other hand, thinner walls, smaller allowances for finishing stock, more positive location of cores, are among the advantages of the shell system. Generally, a shape that can be sand molded can be shell cast.

ADVANTAGES

As noted, the basic advantage for shell molded castings is ultimate lowering of cost. This comes about largely through decreased machining on the casting due to the closer dimensional control that is possible, the superior surface inherent to this method, and due to the high degree of mechanization that is possible.

As against these advantages must be considered the higher initial tooling costs, the higher cost of the sand-resin mix and the large capital investment in molding equipment all of which will tend to increase the first cost of the casting.

Continued on page 50

Singer's New Slant-Needle Model — First machine that's a cabinet *and* portable all in one. First with the needle slanted to make it easy to see and guide the fabric. Finished in soft beige or traditional black.

How Doehler-Jarvis Helped Singer Develop ...a new way to build precision

and make a fine product

Have you seen Singer's new "Slant Needle" Model... the sewing machine designed to make home sewing easier and more convenient?

In one minute it can throw up to 1,500 stitches into your lady's crinolines. It's the only combination portable and cabinet model on the market. (Conversion from one type to the other takes only seconds.) Yet the machine, including motor, weighs under 17 pounds.

Singer can tell you that it's quite a chore to build such features into a machine like this . . . and still keep it competitive. And they're frank to give Doehler-Jarvis major credit for making their job easier with a new method for designing and producing precision parts.

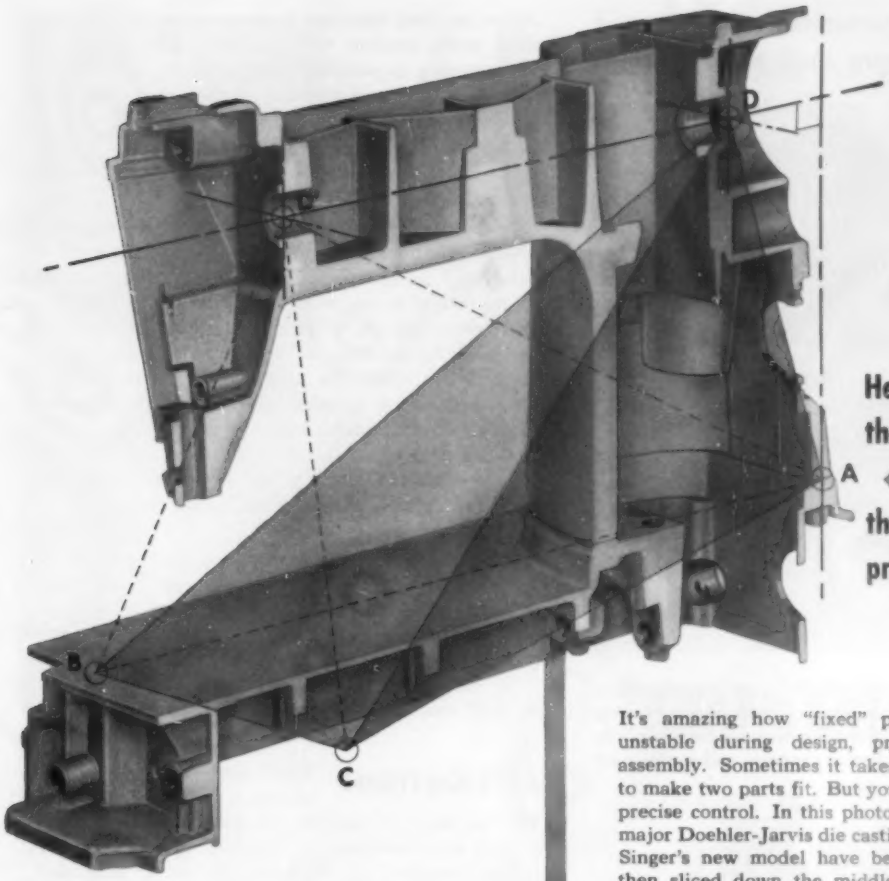
We call this precise new way of making things, "Tripod-Control Dimensioning."

It all started back in '35, when Singer asked Doehler-Jarvis to help pioneer the first die cast aluminum sewing machine components.

To meet the rigid precision requirements, Doehler-Jarvis engineers devised what may have been the first ground and hardened tool-steel casting die ever used. It had its faults, but it did give them machine-tool accuracy. And they discovered the germ of the "Tripod-Control" idea.

What had been discovered was the way to extend a familiar two-dimensional control . . . "baseline dimensioning" . . . to the control of precision in three dimensions. With it they could control precision of and *between* two (or more) die castings of an assembly. They selected a point of vantage common to the parts. Through the point was established a "tripod" of reference from which all critical angles and dimensions could be controlled. Errors vanished. Precision went up . . . assembly troubles down.

Then the idea spread in both the Doehler-Jarvis and the Singer plants. It was used to make multiple gauging jigs . . . used as the basis



Here are the "tripods" that control precision

It's amazing how "fixed" points become unstable during design, production and assembly. Sometimes it takes manhandling to make two parts fit. But you can establish precise control. In this photograph the two major Doehler-Jarvis die castings that frame Singer's new model have been assembled, then sliced down the middle to show the "Tripod-control" method. An imaginary plane of reference, ABC, controls the bed casting dimensions. It passes through point A, a real point of vantage common to both parts. With this plane as a base, imaginary "tripods" are erected to "fix" the plane ADD' and control arm-casting dimensions. The same planes control precision measurements in all following operations.

into parts

finer than ever

for ganged machining . . . used in finishing . . . used in assembly.

By the time the "Slant Needle" model came along, "Tripod-Control Dimensioning" had grown to a full-fledged design and production technique . . . based on die castings . . . used even in the first rough sketches of the new product . . . used in the planning stages . . . used throughout tooling and production.

Today? Well . . . you never saw production flow more smoothly when complex precision parts are made by one company, finished and assembled by another.

In its half century of die casting, Doehler-Jarvis has helped many producers, large and small, find the best way to take full advantage of die casting techniques . . . among them some of the best known makers of automotive, electrical, communication, household, office and other types of equipment.

When they come to Doehler-Jarvis, they know that Doehler-Jarvis can supply both the resources and the resourcefulness they need.

So next time you have a new product on the boards . . . call Doehler-Jarvis in on the design and production engineering. We may be able to give you just the solid kind of help you're looking for.

Doehler-Jarvis Division

of

National Lead Company

General Offices: Toledo 1, Ohio

DOEHLER-JARVIS

* Reg. U.S. Pat. Off.

For more information circle No. 74 on the Reader Service Card

Machinery, transportation equipment and electronics use more shell mold castings

SPECIAL-PURPOSE MACHINERY is an important user of shell mold castings such as the complex-shaped textile machine component, above. This was previously made as a gray iron casting, but is cheaper and better cast in shell molds.

Shell Mold Casting — Cont.

With the trend in metal manufacture toward the procurement of components that are finished or semi-finished as received, of shell mold castings are now being considered and specified for a range of components that had traditionally been finished down from rough sand castings, hogged out of the solid, or from a forging. In fact, wherever a large percentage of the final cost appears in the secondary processing, shell mold castings are worth investigating as an alternative fabricating method.

CASTABLE METALS As mentioned above, almost any castable metal can be utilized. Large tonnages of aluminum, brass, bronze, cast iron, high alloy steels and stainless steels are now being cast commercially by many foundries using the shell mold process.

Smaller quantities of the low alloy steels and the low carbon steels are presently being cast, but the quantity is steadily growing. Some foundries are casting magnesium successfully.

COSTS Where even a moderate number of duplicate parts are to be cast on which there is an appreciable amount of machining when they are cast in green sand molds, then shell mold casting will probably pay-off. Large labor saving is possible due to the high degree of mechanization and also due to the use of unskilled or semi-skilled labor in place of highly skilled molders. Production rates for shells are higher in a well organized foundry when shell molds are used.

Due to their light weight and rigidity, shell molds can be stored for an indefinite period in relatively small space. This enables the foundry to maintain a more uniform molding schedule and hence operate with somewhat fewer workers. Delivery of castings is usually faster and more dependable, after the initial time lag during the construction of pattern equipment. At present the automatic machinery for making the molds is more expensive than for sand casting and becomes obsolete rapidly as new machines are designed, giving rise to high fixed charges.

Cost and savings are the result of complex relationships, and can only be determined on an individual basis. However, enough shell mold castings are now being manufactured on a regular, production schedule to indicate that important savings . . . sometimes well above 50 percent . . . can be achieved by judicious application of shell molding for certain types of components.

APPLICATIONS This has been covered above, but will be restated. The process is capable of making castings for almost any industry or product provided a sufficient number of duplicate pieces is involved. The cost may be lower depending upon the amount of machining required and, it should be noted, founding costs are going down steadily as lowered amounts of resin are needed, as better equipment is made available and as the foundries become more experienced.

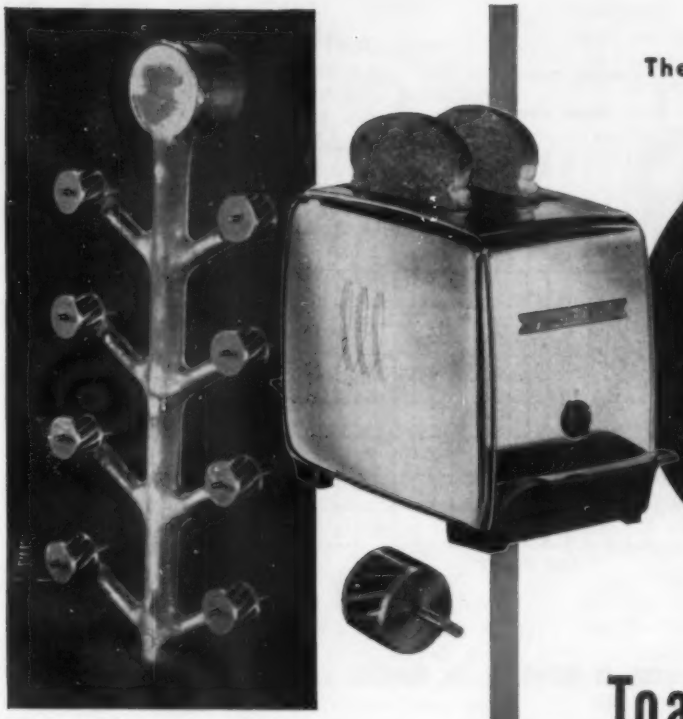
Shell mold castings are being used in a widening field, now including such diverse products as automobiles and textile machines, chemical equipment and electronic instruments, portable tools and small engines, aircraft instruments and household appliances.

Every type of transportation equipment with the possible exception of roller skates now has been given shell molded components: automotive, aircraft, diesel, marine engine, outboard motors, helicopters and submarines.

In the special machinery field, another major group of shell molding uses has developed. This includes not only the textile machinery field already mentioned, but also food processing, printing, conveying, packaging, glass making, shoe making and other equipment.

The potential uses for shell mold casting are great enough that an important segment of the American foundry industry has already introduced or is currently considering the introduction of shell mold departments to complement or replace existing sand casting facilities.

The toaster you never need touch



depends on an electric motor ...SO

Over 600 of these rotor gates are die cast each day, thus producing over 4800 of the finely detailed rotors shown above in two-thirds actual size.

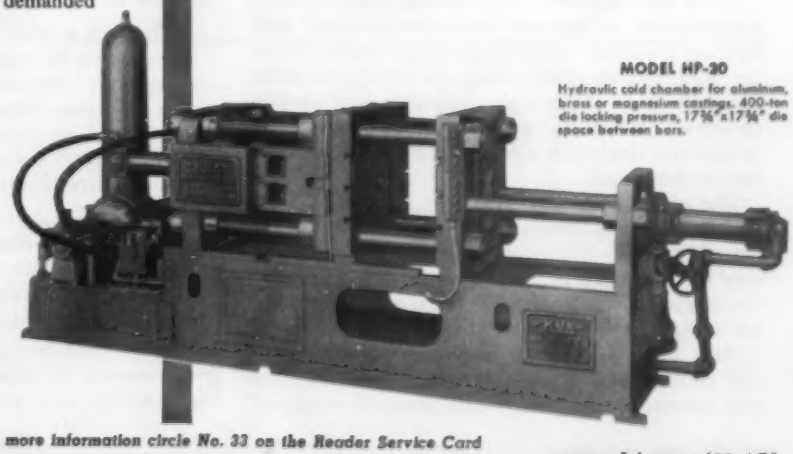
Toastmaster chose KUX die casting machines

to make the heart of the motor... a tiny aluminum rotor

The Toastmaster Products Division of McGraw Electric Company has a recipe for perfect toast with its new Super Deluxe Toaster. Merely place the bread in the toaster . . . it lowers the bread, starts it toasting and serves it up fast . . . all by itself!

It's an amazing automaton, thanks to the tiny aluminum die cast rotor that is the heart of the small powerful motor that serves as the elevator for the bread. A KUX Model HP-20 die casting machine was chosen to produce the rotors because of its long record of dependable service in turning out castings of fine detail and quality. As Toastmaster says, "the rotors meet the high standards demanded of every Toastmaster toaster part."

KUX produces a full range of modern die casting machines that require only the touch of a push button to put them automatically through a complete casting cycle that consistently turns out quality castings at high production speeds. Write for our detailed illustrated catalog.



MODEL HP-30

Hydraulic cold chamber for aluminum, brass or magnesium castings. 400-ton die locking pressure, 17¾"x17¾" die space between bars.

KUX MACHINE CO.

6725 Ridge Avenue, Chicago 26, Illinois

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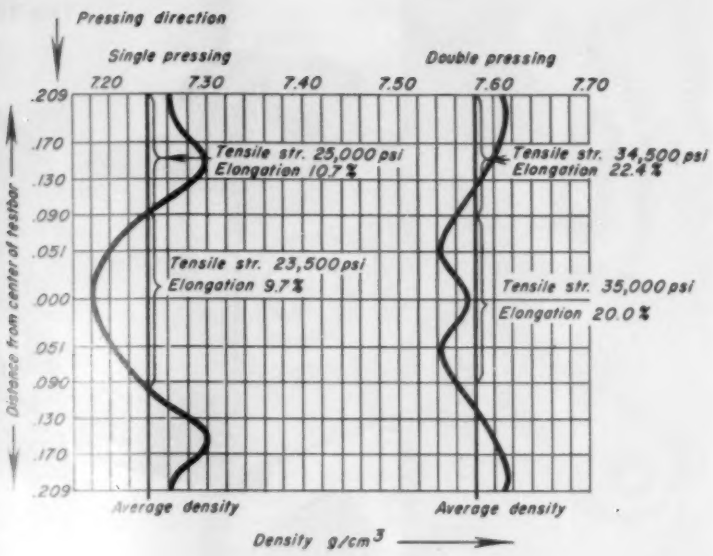

1. DENSITY DISTRIBUTION in test bars pressed from electrolytic iron powder is illustrated here, showing greater uniformity achieved by double pressing.

An Engineer Reports His Company's Experience, in Answering The Question . . .

Can Sintered Steel Be Evaluated From Machined Blanks?

BY DR. GERHARD ZAPF, Manager
Metal Powder Dept., Husqvarna Vapenfabriks Aktiebolag, Husqvarna, Sweden

THE production of sintered structural parts has increased considerably during recent years and developments show a pronounced trend towards higher densities and more specific physical properties.

These developments have enabled sintered steel manufacture to compete with conventional production methods such as casting, forging, turning, milling and others. Intricate structural parts formerly made of castings, malleable iron, carbon or low alloyed steels have been made successfully of sintered steel with equal or superior properties and performance.

The criteria for successful applications of high density sintered steel are the reports from some firms[1,2] on their successful experiences. Many new concerns are interesting themselves in powder metallurgy primarily to utilize the specific advantages of high density production.

High density parts require iron powders having good pressing and sintering characteristics and correspondingly high final strength obtained at reasonable pressing pressures. In this field the superiority of electrolytic iron powder appears. Through the use of double pressing and double sintering, the high demands for tensile strength and elongation have been met plus close dimensional control and good wear resistance.

There is a wide range of alloys and densities from which to select suitable material in powder metallurgy. An examination of the available data and a working knowledge of the size and shape limitations in powder metallurgy enables consideration of this method of production for the manufacture of any specific item.

Based on knowledge of various powders' characteristics and earlier experience with them, it can often be determined at once whether a sintered part can successfully replace a cast, forged or machined part. Of course, cost consideration must always justify the switch.

However, in many cases the only method of evaluation is to test the sintered steel under the

actual service conditions involved. Since it is, generally speaking, too expensive and time consuming to make tools with which to press parts for test, it would seem a good idea to machine parts from sintered blanks and, if necessary, heat treat or electroplate them before testing.

Pros and Cons

Opinions differ on the results obtained from a part machined from sintered blanks vs. a part pressed to the required shape. Some feel that the machined blanks give inferior results, due to the fact that the surface-layer, which has the highest density, has been removed, thus lowering the part's strength and wear-resistance.

Others feel that the results are better, because the part machined from a blank would probably have more equal density distribution than the part pressed to shape. The truth lies between these two extremes, as we will show.

For eight years high density structural parts have been tested and successfully produced for sewing machines, bicycles, motorcycles and small arms at the plant of Husqvarna Vapenfabriks AB only after proper evaluation of sintered steel structural parts machined from sintered blanks. Generally, when parts are converted from some other method of manufacture to powder metallurgy, the physical and dimensional specifications have been tightened, requiring the production of a better part by powder metallurgy.

By machining and testing, Husqvarna has found that any heat treatment and/or surface treatment required can be established at this stage on the parts made from blanks.

A study of dimensional changes in connection with sintering, heat treatment and surface treatment enables the establishment of precise dimensions for the proper design of pressing tools. Indirectly this insures closer tolerances and a better realization of them. Furthermore, practical tests for subsequent production control can be devised and worked out at this time.

How Physical Properties Are Developed

Before going into case histories of parts tested and perfected by this technique, it would be well to review the action which occurs in the pressing of loose metal powders.

When a powder is pressed in a die to make a part, the pressure on the powder behaves pseudo-hydrostatically during a very short period (approximately while the density grows from the value of apparent density to tap density)[3].

After passing through this phase, pressure is transmitted only in the pressing direction or within a small deviation from the pressing direction. To facilitate equal density in every section of the part, the tool must be made with split punches.

The press design and limit the shape and number of individually controllable sections of the punches. Husqvarna has used as many as eight individually controlled punches in a cavity in multiple cavity dies, which are mounted on single acting presses.

Continued on next page

RESULTS OBTAINED FROM TEST BARS: MACHINED-TO-SHAPE VS CAST-TO-SHAPE

Table 1: Straight Iron Powder

Density	TYPE OF TEST BARS					
	MPA TEST BARS		TURNED FROM BARS		TURNED FROM BLANKS	
g/cm³	Tensile, psi	Elong.	Tensile, psi	Elong.	Tensile, psi	Elong.
7.0	32,000	24.5%	32,500	25.6%	32,000	26.0%
7.2	34,500	28.4%	35,000	32.4%	35,500	30.0%
7.4	37,500	37.4%	40,000	35.8%	41,000	35.4%

Table 2: Electrolytic Iron Powder + 2% Copper

Density	TYPE OF TEST BARS					
	MPA TEST BARS		TURNED FROM BARS		TURNED FROM BLANKS	
g/cm³	Tensile, psi	Elong.	Tensile, psi	Elong.	Tensile, psi	Elong.
7.0	54,000	9.7%	54,000	10.6%	56,000	12.0%
7.2	60,000	13.4%	59,000	15.3%	61,000	17.0%
7.4	64,000	18.6%	60,000	20.5%	62,000	22.2%

These Three Production Parts Were Tested By Machining From Sintered Blanks:

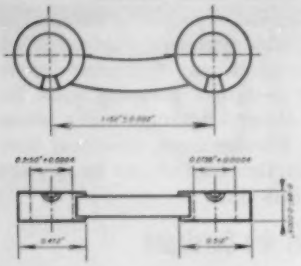

TABLE 3

MATERIALS TESTED	Hardened carbon steel		Machined sinterosteel		Pressed sinter-steel	
	Hole A	Hole B	Hole A	Hole B	Hole A	Hole B
Diameter before	0.31508	0.27563	0.315390	0.27653	0.31516	0.27571
Diameter after	0.31512	0.27567	0.315390	0.27657	0.31520	0.27571
Difference	0.00004	0.00004	0.00000	0.00004	0.00004	0.00000

Sewing Machine Guide Arm

The demands for mechanical strength are not especially high in this part, but the wear resistance must be very good. The tolerances must be kept very close and, therefore, the part was proposed to be made from sintered steel. In order to determine the wear resistance, some parts were machined from blanks and tested together with conventionally made parts.

This investigation gave promising results and it was decided to make the part of sintered steel. The operation scheme was perfected on slugs from which the test parts were made.

The final cycle was:

1. Prepressing
2. Sintering
3. Repressing
4. Resintering
5. Coining: Final density 7,2g/cm³.

The formerly used material was hardened carbon steel. The sintered part is made from straight HVA electrolytic iron powder and is used in the coined condition. Test-time-704 hours at 1000 RPM.

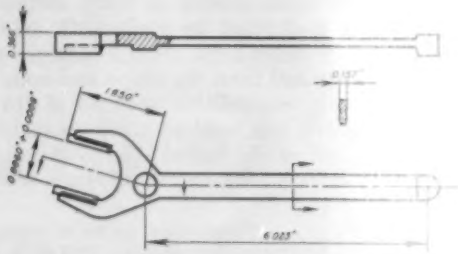

TABLE 4

Materials tested	Forged steel	Machined from sintered blanks	Pressed sintered steel
Dim. before	0.88618	0.88603	0.88591
Dim. after	0.88644	0.88642	0.88622
Difference	0.00048	0.00039	0.00031
Wear	0.00024	0.00020	0.00015

Sewing Machine Feed Fork

This part has to withstand a relatively high impact load on the surfaces in the fixed jaw. To test the proposed sintered steels, plates of those steels were made and soldered to a conventional fork. The plates were then ground to final dimensions and tested.

As the tests gave satisfactory results it was decided to make this part of electrolytic iron powder with 2% copper. Production cycle includes double pressing, double sintering and coining to straighten the extremely long part. The surfaces in the gap are ground as a final operation.

Testing cycle 552 hours = 33,120,000 revolutions. The figures in the table are the average of six different measurements in each jaw.

Since 1952 this part has been made on a production scale and has served excellently.

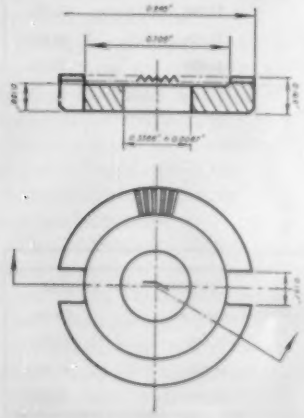

TABLE 5

MATERIALS TESTED	Machined from bar stock	Machined from sintered blanks	Pressed sinter-steel
Breaking load lbs.	2200-2380	2230-2280	2160-2300
Hardness R30N	50-65	58-57	50-55

Bicycle Lock Washer

This part was earlier made from bar stock in an automatic screw machine. Calculations showed that it would be economical to produce it by powder metallurgy. But could sufficient hardness and strength be achieved?

A series of test pieces was machined from sintered cylinders of Cu-steel, carburized and hardened. Hardness and breaking load in a rupture test were estimated. A minimum breaking load of 1760 lbs. had been fixed after testing washers produced by previous method. A density of the sintered washers of 7.2-7.3 g/cm³ more than met this requirement.

A Metallurgist Discusses The Question . . .

Do Test Bars Give A True Picture Of Properties Of Investment Castings? Part 1

BY DR. NICHOLAS J. GRANT
Department of Metallurgy, Massachusetts Institute of Technology

THE problem of selecting or of specifying a test bar or a testing procedure whereby the test sample must describe and define a casting is not a simple one. The regular foundry industry has faced this problem for many, many years and has not come up with a simple solution.

There are several reasons for selecting or specifying a test or test bar, these are:

1. To establish a measure of the properties of the alloy
2. To determine the properties of the casting
3. To determine a proportionality between the test and the casting.

Sometimes a test bar is specified or designated; on other occasions an attached heavy section may be cast for the purpose of providing a sample for a general evaluation of the cast structure without specifically looking for precise or exact mechanical or physical property; or sometimes the casting itself serves as the source of a test specimen or the source of the test bar (in this case the casting is destroyed, but may give information not attainable otherwise).

The Requirements of a Test Specimen

In order for a test bar or a sampling technique to be effective, it must meet at least a majority of the following specifications:

1. It must have the element of being inexpensive
2. It must be simple and not slow down production
3. It must be informative and translatable to the casting.
4. It must be representative, reliable, and reproducible.

If the procedure is neither cheap nor simple, it may be preferable to avoid casting test bars or samples; instead it may be much simpler to utilize the casting itself as a means of measuring the properties. Furthermore, unless translated information is obtained from the test bar or sample, it is useless to specify the test. Finally, if the test itself is not reproducible or representative, then it cannot be utilized as a measure of the properties of the casting.

General Difficulties in Producing Investment Cast Test Samples

There are a number of general reasons why testing procedures and test specifications encounter difficulties. After examining some of them it will be desirable to look at specific instances where difficulties arise in utilizing test procedures.

1. Difficulties arise because there is a difference in the section size and shape of the test bar as compared to the actual casting.
2. Differences arise because there is a different rate of freezing and cooling of the test bar as compared to the casting proper, resulting in differences in the structure and properties of the test and casting.
3. Differences arise due to improper positionment of the test bar or sample with respect to the casting. From this arises the question as to whether the sample casting or test bar should be cast in a separate flask, cast in the same flask and attached to the casting, or taken directly from the casting (destructive testing) in which case there still remains the question as to where in the casting the sample should be obtained to be most representative.
4. Difficulties arise simply because of the peculiarities or properties of the metals or alloy selected for the casting program, that is, is the alloy readily oxidizable, does it dissolve gases readily, is there a transformation, etc.

Specific Difficulties in Producing Investment Cast Test Samples

Specific difficulties which give rise to problems of specify-

Continued next page

ing or interpreting the results of test bars and sampling techniques are the following:

1. *Segregation.* In the casting of pure metals, segregation is seldom a difficulty, the degree of difficulty depending on the actual purity. This is due to the fact that pure metals solidify at a well-defined temperature. Thus one would not expect difficulty in casting 99.96 percent aluminum, but might expect some difficulty in casting commercially pure aluminum, such as 2 S aluminum, which analyzes only 99.2 percent aluminum. In the case of alloys, however, due to the fact that alloys solidify over a range of temperatures, and therefore over a composition range, segregation takes place which gives rise to problems of variation of properties from one location in the casting to another, especially as influenced by differences in section size or section shape.

2. *Gases in metals.* Because gases are readily soluble in most liquid metals and alloys, and are as readily released on freezing, there is always danger that trouble will be encountered during casting. These gases will, of course, come out of solution on freezing as a function of the rate of solidification, and also as a function of the solidus — liquidus temperature range for the alloy.

It means that one must expect to encounter differences between test bars which are ¼ inch in diameter as compared to the casting proper, which may be from 1 to 2 inches in diameter. In the casting itself, due to slower solidification, the difficulties due to gas evolution on freezing may be considerably more severe than in the case of the test specimen.

This article is based on a paper presented before the annual meeting of the Investment Casting Institute.

3. *Alloys subject to aging.* Aging is, of course, a function of the temperature and the time at temperature during which precipitation of the excess phase takes place. As might be imagined, this means again that differences in the cooling rate when passing through the range of aging temperatures will have an important effect on the properties of the alloy.

Here again a difference in section size of the cast specimen as compared to the casting proper may show an important difference in properties if one utilizes the test specimen as a means of gaging the properties of the material. In systems where aging does not occur, this is not a problem.

4. *Phase transformations.* Transformations are a specific problem in the case of almost all of the ferritic steels. The austenitic steels are generally exempt from this as a problem. Again the important factors are

Continued on page 87

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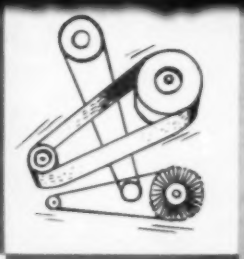
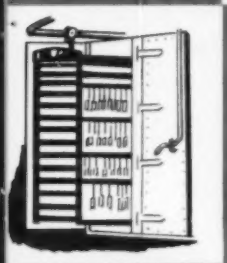
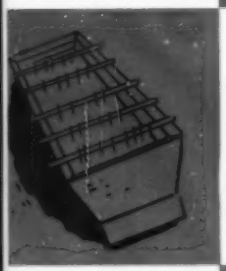
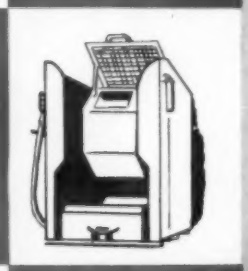



PMM

Finishing Section

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

devoted to the specialized problems of finishing . . .

DIE CASTINGS • INVESTMENT CASTINGS • PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS • POWDER METAL PARTS • SHELL MOLD CASTINGS

Are you BARRED

from planned assembly savings

BY A THREAD?

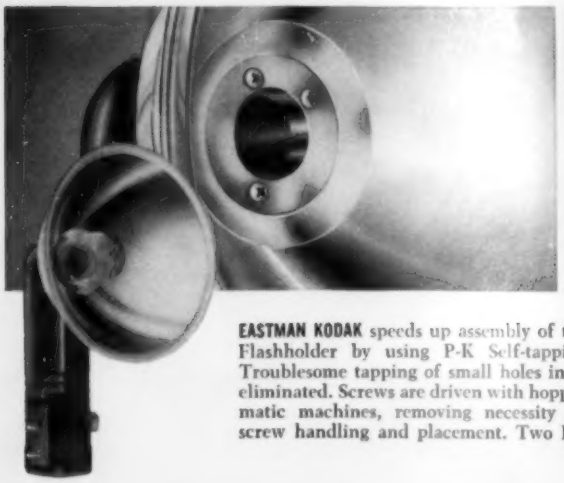
Screws can be "trouble-bent" in many ways. Most thread faults like those listed here are invisible, but their effects (job slowdown, parts spoilage, high reclamation expense, hidden weakness) show clearly in assembly costs and customer complaints.

That's why P-K quality standards have been set so high—to make sure you get Self-tapping Screws that are not only threaded, but headed, pointed and heat-treated with one purpose in mind, to keep your assembly lines trouble-free.

For information on any fastening problem, talk to a P-K Assembly Engineer. Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14. Chicago Warehouse, 4331 West Lake St., Chicago 24.

IS DIAMETER OFF-SIZE?
— means hard driving
— breakage
— weak fastenings
DO THREADS STOP SHORT OF HEAD?
— means loose screws
ARE THREADS RAGGED and SEAMED?
— makes driving difficult
ARE THREADS TOO SOFT?
— means spalled threads
ARE THREADS TOO HARD?
— means stripped threads
IS POINT (on Sheet Metal Screws) BLUNT?
— makes starting difficult

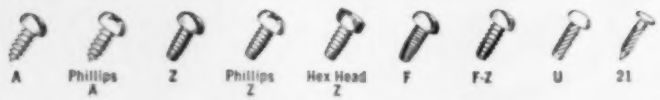
P-K STANDARDS PROTECT you against the thread faults illustrated and many others that will cause assembly trouble and weak fastenings. They don't "get by" P-K inspectors—that's why all P-K Self-tapping Screws can be "Guaranteed First Quality."



EASTMAN KODAK speeds up assembly of the Kodalite Flashholder by using P-K Self-tapping Screws. Troublesome tapping of small holes in plastic was eliminated. Screws are driven with hopper-fed automatic machines, removing necessity for tedious screw handling and placement. Two P-K Phillips Head Type F Screws fasten a cover mounting bracket to the flashholder case (right) and three more fasten the metalized Tenite II reflector to the case (left). Case is a thermo-setting phenolic. Screws hold firmly under all stresses of normal use, can be removed for attachment of new reflector.

PARKER-KALON

The First SELF-TAPPING SCREWS



IN STOCK . . . see your nearby P-K Distributor

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One stumbling block to further use of magnesium die castings has been the difficulty in securing a good chromium plate. Now one company reports how it is doing . . .

Production Plating of Magnesium Die Castings

By **LEO D. GODDEYNE** and **DENNIS J. GODDEYNE**
Goddeyne Manufacturing Co., Bay City, Michigan

A considerable amount of pilot plant work and limited job shop production preceded the decision to undertake the plating of a die cast magnesium rule case for The Lufkin Rule Company of Saginaw, Mich. Since this rule case has gone into production, hundreds of thousands of case components have been electroplated with a copper, nickel, and chromium finish using the process developed by H. K. DeLong of The Dow Chemical Co.

Selection of Finish

The Lufkin rule case is being finished in a satin chrome finish rather than a buffed mirror finish. Several factors influenced the decision to select this general type of finish. The rule itself was designed for rugged service in the workshop, by builders on the job, and around the home. The satin chrome finish is attractive and, at the same time, provides the type of finish that does not show scratches or wear. In other words, it provides a finish that is as durable as the rule and case.

The selection of this satin finish permits us to finish the parts on an abrasive belt prior to plating. The parts then continue through all of the plating operations without extra wheel work. This finish, which minimizes intermittent wheel operations and re-racking, brings the cost of finishing the case into a range competitive with the finish of zinc-base die castings.

Finishing Procedure

The basic steps which will be described in detail are common to most electroplating processes with the exception of the zinc immersion coating. After necessary operations are performed on the base metal to provide the desired texture or luster, subsequent steps are needed to secure the clean, homogenous surface condition required before any of the metallic coatings can be applied.

The sequence of operations required for the electroplating of the magnesium die cast rule case are summarized in the following:

1. Removal of foreign contamination
2. Flash removal and satin finishing
3. Cleaning
4. Activating
5. Zinc immersion coating
6. Copper strike
7. Copper plating
8. Nickel plating
9. Chromium plating

Details Of 9-Step Finishing Cycle On Next Page

Here Are The 9 Steps To Plate A Magnesium Die Casting . . .

1 *Removal of Foreign Contamination:*

The surface of the die casting as received from the caster contains some non-metallic contamination including some oxide and graphite base lubricant as well as some inverse segregation of aluminum. Since only a part of the die casting is to be machined, it is necessary that this contamination be removed by pickling in the areas not machined. The following aqueous solution is used in the pickling operation:

Chromic acid (CrO_3) .....37½ oz.
Conc. nitric acid ($70\%HNO_3$) ... 3¼ oz.
Hydrofluoric acid ($60\%HF$) ..... 1 fl. oz.
Water ...to make 1 gallon

The castings are pickled for from one to three minutes depending on the age of the bath. This solution is contained in a Koroseal lined tank and is operated at 70-90 F. It is necessary to surround the pickling tank with a refrigerated water jacket to prevent the temperature of the solution from rising excessively when any quantity of die castings are pickled. The parts are processed in a Lucite cylinder which revolves in the pickling solution in order to achieve a uniform pickle. After pickling the parts are rinsed in water and dipped in a weak alkaline solution to counteract residual chromic acid.

2 *Flash Removal and Satin Finishing:*

Both of these operations are performed on a five station index type rotary automatic polishing machine. The machine is fitted with special cammed fixtures to allow a polishing attachment to follow the eccentric periphery of the case.

The cases are assembled prior to machining and are machined in pairs. This pairing is maintained throughout the plating process and final assembly of the tapes.

Flash is removed with 100 grit aluminum oxide abrasive belts. The satin finish is applied with 120 grit aluminum oxide abrasive belts. A very small amount of greasy compound on the belts to prevents loading.

3 *Cleaning:*

The parts are racked in a predetermined pattern on racks of conventional copper bar construction, coated with a regular Plastisol-type baked coating. Twenty complete rule cases are plated on each rack, or a total of 40 castings. The parts remain racked throughout the entire plating process.

It is important that the Plastisol coating especially in the area of the rack tip be inspected regularly. Loose coating or holes could form pockets which might carry small amounts of solution from one tank to another causing contamination. This inspection must be thorough because of the low chromic acid tolerance of the subsequent zinc immersion solution.

In the case of the particular die casting under discussion, because only a very small amount of greasy compound is used on the abrasive belts and because the inside of the case is not dirty, cleaning does not constitute a problem.

The castings are cleaned anodically using a reverse current. Wyandotte FS cleaner is used in a concentration of four ounces per gallon at an operating temperature range from 170 to 190 F with approximately 40 amp per sq. ft. for a period of one to four minutes.

4 *Activating:*

After cleaning, and prior to the zinc immersion coating, the surface is activated by immersion for 20 seconds in an aqueous solution of the following composition:

Phosphoric Acid ($85\%H_3PO_4$) .. 1.6 pts.
Sodium, potassium or ammonium acid fluoride ($NaHF_2$, HKF_2, or NH_4HF_2) ....13-1/3 oz.

This bath is used at 70 to 90 F.

5 *Zinc Immersion Coating:*

After several attempts to use a more concentrated zinc coating bath, it was decided in the interests of better adhesion to use the less concentrated bath. This latter formed the zinc coating more slowly, but under normal operating conditions, adhesion seemed better. The aqueous solution used in the zinc bath was as follows:

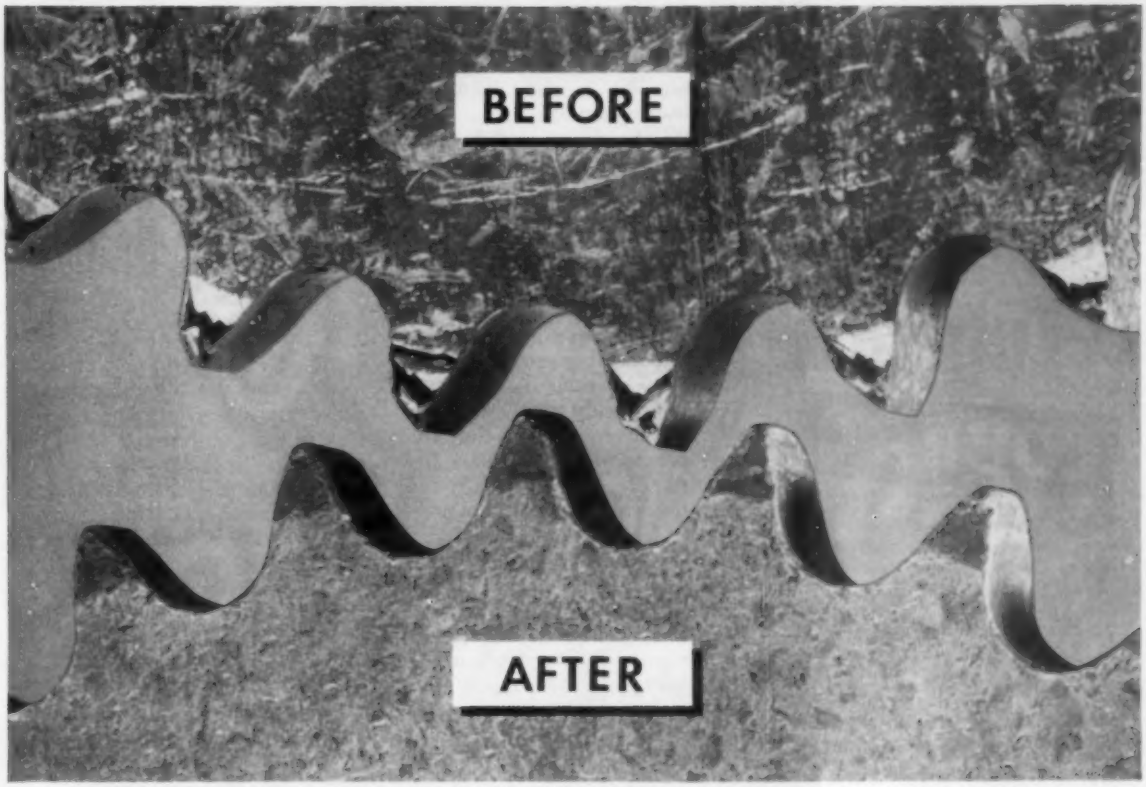
Tetrasodium Pyrophosphate ($Na_4P_2O_7$) .....16 oz.
Zinc Sulfate Monohydrate ($ZnSO_4.H_2O$) 4 oz.
Potassium Fluoride (KF) .....0.94 oz.
Potassium Carbonate (K_2CO_3) .....0.67 oz.
Water .....to make 1 gal.

The bath is operated at 175-180 F with mild agitation. Prolongation of time decreases adhesion. The bath is operated at a pH which ranges between 10.0 and 10.6 colorimetric. Early experience with this bath led us to believe that the bath life was short, but we discovered that with the mastering of analytical techniques, additions could be made to the bath to prolong its life with no adverse effects.

6 *Copper Strike:*

After application of the zinc immersion coating, the parts are given a thin copper deposit in a Rochelle salt copper strike of the following composition:

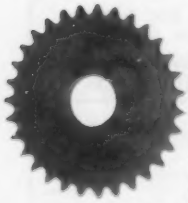
Continued on page 62



BEFORE AND AFTER *photos show how the HONITE Method finishes steel roller chain sprockets. Note how smoothly and evenly the stubborn hobbing burrs have been removed.*

Milwaukee manufacturer finds . . .

HONITE BARREL FINISHING CUTS COSTS 60%



The Chain Belt Co., of Milwaukee, Wisconsin, makes 7½" diameter steel sprockets for roller chains in large quantities. On this unit the company cut two finishing steps to only one . . . cut finishing costs from 6½¢ per unit to 2½¢ . . . cut unit finishing time by 35% . . . when they switched to the Honite Barrel Finishing Method.

Here's how. The company formerly used grinding and hand-filing methods to remove hobbing burrs and de-scale and de-grease sprockets. Now, with the recommended Honite Method, these steps are performed simultaneously. And with a more uniform finish, parts are cleaner; burrs and scales are eliminated completely.

Find out today how Honite Barrel Finishing Methods can increase production, cut unit costs, give better, more uniform finishes faster. You'll be money ahead if you put the Honite Method to work in your plant. Call your Honite Methods Engineer or nearby Honite Distributor for complete facts.

Honite BRAND

MINNESOTA MINING AND MFG. CO.
Dept. PM-25, St. Paul 6, Minn.

☐ Send me FREE "Facts and Figures Report on HONITE Barrel Finishing"

☐ I'd like to talk with a HONITE Methods Engineer

Name.....Title.....

Company.....

Address.....

City.....Zone...State.....

Type of products to be finished.....

Made in U.S.A. by Minnesota Mining and Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: P. O. Box 757, London, Ont., Can. Export: 99 Park Ave., New York City. Makers of "Scotch" Pressure-Sensitive Tapes, "Scotch" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing.

3M

For more information circle No. 69 on the Reader Service Card

COBRA C is the *new* chromate finish for high corrosion protection and bright finish on copper, brass or bronze. Can be used on solid or plated copper or brass; for cleaning and deoxidizing copper or brass parts; for removing flux on soldered parts.

Just *one* advantage of Luster-On COBRA C is that it can be diluted . . . cutting costs for you up to 25% over regular COBRA.

COBRA C eliminates hazardous nitrous oxide fumes that most bright brass treatments give.

COBRA C can be used at room temperatures or slightly elevated.

And, IN ADDITION, COBRA C

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- Stands over 100 hours standard salt spray; assures long life.
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- Replenishment possible with same concentrate.
- Exhaust of bath in use is optional — not required.
- Excellent paint bond qualities.

LUSTER-ON® — the first in the field and still the leader.

Write for full data sheets, and send a part for free processing. L-14

THE Chemical CORPORATION
66 Waltham Ave., Springfield 9, Mass.

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How To Plate Magnesium Die Castings—Cont.

Copper Cyanide (CuCN)	5.5 oz.
Sodium Cyanide (NaCN)	6.8 oz.
Sodium Carbonate (Na_2CO_3)	4.0 oz.
Rochelle Salt ($KNaC_4H_40_6 \cdot 4\ H_20$)	6.0 oz.
Sodium Hydroxide (NaOH)	1.0 oz.
Free Cyanide	0.75 oz.
Water	to make 1 gal.

The operating temperature is 120 F. Electrical contact is made as quickly as possible at a high current density of 30 amp per sq. ft. for the first 30 seconds. The current density is then decreased to 20 amp per sq. ft. for five and one-half minutes. The pH is maintained at 10.0 or slightly below.

Failure to cover the zinc immersion coating with copper may result in deterioration of the coating in the copper cyanide solution. For this reason it is necessary to use a high initial current density as described above.

7 *Copper Plating:*

A pyrophosphate-type copper solution was selected because of its wide brightness range and because it does not present as serious a waste disposal problem as a cyanide solution. The pyrophosphate bath is modified by the addition of 30 to 60 grams per liter of potassium fluoride, to minimize attack in the event of porosity in the strike or failure to cover. A minimum of 0.0008 of copper is deposited in this solution operated at 130 F for a period of approximately 35 minutes at 25 amp per sq. ft.

8 *Nickel Plating:*

A Watts-type bright nickel solution, operating at a pH of 4.5, was selected for nickel plat-

DISTRIBUTORS

CALIFORNIA: LOS ANGELES, Crown Chemical & Engineering Co.
CONNECTICUT: GREENWICH, Tumbling Sales & Service; STRATFORD, Precision Tumbling & Supply Co.
ILLINOIS: CHICAGO, Crown Rheostat & Supply Co.
INDIANA: INDIANAPOLIS, Platers Supply Co.
MICHIGAN: GRAND RAPIDS, Haviland Products Co.
MINNESOTA: MINNEAPOLIS, Industrial Chemical & Equipment Co.
MISSOURI: ST. LOUIS, Sommers Bros. Manufacturing Co.
NEW JERSEY: KEARNEY, Frederick Gumm Chemical Co.; NEWARK, Metal Finish Inc.
NEW YORK: BROOKLYN, Pusso Plating Equipment Corp.; BUFFALO, S. A. Day Manufacturing Co.; TUCKAHOE, Lupoline Automatic Polishing Equip.
OHIO: CINCINNATI, Mechanical Finish Company; CLEVELAND, Stanley Supply Company
PENNSYLVANIA: LANCASTER, J. Harry Lightner
ONTARIO, CANADA: WALLACEBURY, South West Supply Co.

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Other tumbling supply companies charge 15¢ a pound for these same chips. We charge only . . .

8¢ LB. Packed in 100 lb. bags. Prices f.o.b. Detroit.

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Chip Size	Pass Thru		Stay on Top	
No. 1	1 5/8"	Mesh Screen	1 1/2"	Mesh Screen
No. 1A	1 5/8"	Mesh Screen	1 1/2"	Mesh Screen
No. 1B	1 1/2"	Mesh Screen	1 1/4"	Mesh Screen
No. 2	1 1/4"	Mesh Screen	7/8"	Mesh Screen
No. 2A	1 1/4"	Mesh Screen	1"	Mesh Screen
No. 2B	1"	Mesh Screen	7/8"	Mesh Screen
No. 3	7/8"	Mesh Screen	5/8"	Mesh Screen
No. 3A	7/8"	Mesh Screen	5/8"	Mesh Screen
No. 3B	5/8"	Mesh Screen	5/8"	Mesh Screen
No. 4	5/8"	Mesh Screen	3/8"	Mesh Screen
No. 4A	5/8"	Mesh Screen	1/2"	Mesh Screen
No. 4B	1/2"	Mesh Screen	3/8"	Mesh Screen
No. 5	3/8"	Mesh Screen	1/2"	Mesh Screen
No. 5A	3/8"	Mesh Screen	3/8"	Mesh Screen
No. 5B	3/8"	Mesh Screen	1/2"	Mesh Screen
No. 6	1/2"	Mesh Screen	3/8"	Mesh Screen

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For more information circle No. 73 on the Reader Service Card

ing. Parts are plated with a minimum of 0.0002 nickel, or for approximately 15 minutes at 25 amp per sq. ft. The operating temperature is 130 F.

9 *Chromium Plating:*

Little difficulty is experienced in this step if the other metals have been deposited properly. A standard chromic acid type bath is used. Because of the small size of the parts, it is not economically feasible to rack them on special racks before chromium plating.

Adhesion

Adhesion of the electrodeposits on the rule case die casting is normally excellent. Most cases of poor adhesion noted were the result of improper processing in the zinc immersion or copper strike process. Exceptionally fine adhesion has been obtained in plating wrought magnesium.

As one example, on a test, magnesium wire in diameters as low as 60 mils was electroplated with sufficient adhesion to permit bending a length of wire back on itself, around zero radius, with no failure in adhesion. The copper coating fractured but did not break away from the base metal.

Corrosion resistance of these rule cases follows the same pattern as has been reported previously on coatings of similar thickness on magnesium.

Summary

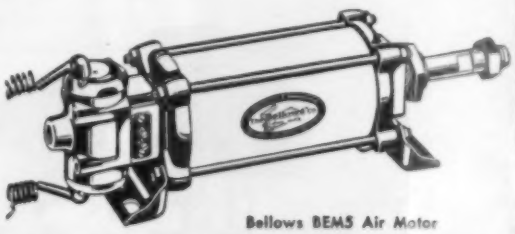
The production electrofinishing of the die cast magnesium rule case for The Lufkin Rule Company has proved definitely the practicability of this process for plating magnesium. The various solutions and procedures described in this paper are basically the same as those described in the Magnesium Finishing Handbook published by The Dow Chemical Company. The lone important exception is the modification of the zinc immersion coating.

Although this paper discusses the steps used in finishing a specific die casting, experience on other castings, plated during this same period of time, indicates that the problems encountered and solved are typical. Experience with other die castings also indicated that this rule case was a more difficult part to plate than an average die casting, perhaps due to its small size and thin wall sections.

Editor's Note: This article is based on a paper given before the recent annual meeting of The Magnesium Association.

EXPAND CHICAGO SALES

Enthone, Inc., New Haven, Conn., manufacturer of metal finishing and electroplating chemical products, announces the assignment of additional territory to their Chicago manufacturing distributor, ARDCO, Inc. Through their resident sales engineer, James P. Hendrickson, ARDCO will now service southern Illinois and eastern Michigan from Mr. Hendrickson's office at 3733 Washington Blvd., St. Louis, Missouri.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When it comes to down-right value, the Bellows Air Motor (the air cylinder with the built-in valve) tops them all for both standard air cylinder operations or as a component in new design applications. Not only are you buying a precision-built power unit — but you are buying a complete power unit. No extra valves to buy—dual speed control valves as well as directional valve are integral with the cylinder; no cumbersome, complex piping to install—a single, flexible air hose is all the hook-up you'll need.

You can have your choice of built-in directional valves: 110 volt or 8 volt electrical control, standard or explosion-proof, manual control, or air poppet valve control. Five bore sizes: 1¼", 1¾", 2½", 3⅛", and 4½" Any stroke length.

SP-50

CL-50

WRITE FOR THESE TWO BULLETINS: Contain full data and specifications on Bellows Air Motors. Free. Address Dept. PMM 255 The Bellows Co. Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto.

The Bellows Co.
AKRON 9, OHIO

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For more information circle No. 67 on the Reader Service Card

INDUSTRIAL FINISHING SHOW SET FOR CLEVELAND IN JUNE

The 1955 Industrial Finishing Exposition, feature of the 42nd Annual Convention of the American Electroplaters' Society in Cleveland, is scheduled to take place in Public Auditorium there, June 20 through 23, 1955.

Cleveland is preparing for 12,000 or more expected for the convention and show, according to Eugene L. Combs of Diamond Alkali, general chairman for the Society's gathering.

An indication of the interest in the Industrial Finishing Exposition to be held in the same big auditorium with the Society's technical sessions, is the report that already more than two-thirds of the space allotted for exhibits has been taken.

The members of the national board of the A.E.S. met in Cleveland October 23 to complete the plans and programs.

NEW METALWORKING MOVIE

A color sound movie, illustrating the use of wax coolants in the metalworking industry, has been produced by S. C. Johnson & Son Inc.

Titled, "Metalworking With Wax," this documentary film describes the properties of wax as well as its functions in the metalworking process.

The movie is available for showings from the Johnson's Wax Industrial Products Department at Racine, Wis. Running time is 25 minutes.

CHANGE DIV. NAME

Enthone, Inc., manufacturers of chemical products for metal finishing has announced a change in the name of its division formerly known as Conn. Metalcraft, Inc. The new name will be Comco, Inc. This corporation, 442 Elm St., New Haven, Conn., designs and manufactures plating racks, fixtures, filters, plastic tanks, ventilating ducts and sells general equipment for the electroplating industry.

AUTOMATIC BARREL PLATING SUBJECT OF FILM

A 16 mm. sound motion picture featuring automatic barrel plating and processing in a true "automation" role is available from Frederic B. Stevens, Inc.

The operational economy obtained from continuous automatic barrel zinc and cadmium electroplating, bright dipping, rustproofing and washing operations is described. The major portion of the film was made in the new Elgin, Illinois, plant of Illinois Tool Works' Shakeproof Division.

In addition to showing the continuous metal finishing and processing cycles, which are handled by single operators, the film features the complete supporting straight-flow "automation" operation from inception of the product through the final finishing treatment.

To make arrangements for a showing of "Industrial Album" companies or groups should call the nearest Stevens sales office or write direct to Frederic B. Stevens, Inc., Detroit 16, Mich.

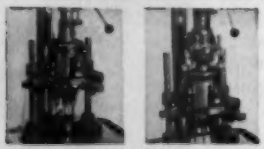
F. W. McINTYRE SR. RETIRES

After 35 years with Reed-Prentice Corporation, Worcester, Mass., F. W. McIntyre, Sr. has retired. Mr. McIntyre was elected president of Reed-Prentice in 1944 and became chairman of the board in April, 1954. He is now acting in a consulting capacity with the Company and is not active as an officer.

Taps or drills over a million different hole combinations

The NEW

ETTCO-EMRICK Flex-Shaft Adjustable Spindle Multiple Head



IT DRILLS — IT TAPS. Takes only a moment to convert. 1:1 drive ratio ideal for lead screw tapping.

FLEXIBLE SHAFT SPINDLES are positioned quickly, accurately even while unit is running.

FLEXIBLE SHAFTS run in either direction without unwinding, whip or vibration — can be removed in seconds.

- Exclusive flexible shaft drive spindle design makes it the most versatile, most easily adjusted head ever. It's just what the doctor ordered for stepping up production and slashing costs on an unlimited variety of small parts tapping and drilling. It's virtually a complete production line — all in one compact, lightweight, low-cost unit.
- Ingenious flex-shaft spindle design with quick adjustment feature on each spindle gives wider range of settings — cuts set-up time way down.
- The only head of its kind that taps or drills on any drill press without use of reversing motor.
- For horizontal or vertical tapping or drilling.
- Needs no special engineering — you put it to work on your jobs at once.
- Capacities up to 5/16".
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For more information circle No. 21 on the Reader Service Card

THE FINISHING TOUCH

GOLD PLATED ZINC DIE CASTINGS, representing a large part of more than 600 automotive trim parts on the 1955 Chevrolet, are one of the main luxury appearance features of General Motor's 50,000,000th automobile, the Golden Chevrolet.

To plate gold to an exact color match is difficult, and depends upon close control of 1) temperature of the plating solution, 2) length of time of the cycle, and 3) composition of plating bath. These die cast parts were given conventional preliminary copper and nickel coats, to prevent amalgamation of gold with the base metal.

Copper-nickel plated pieces were colored with rouge on a linen wheel, racked, electrolytically cleaned to remove buffing compound and dirt.

The copper -nickel plated pieces were then processed as follows: 1) colored with rouge using linen wheel; 2) racked; 3) electrolytically cleaned; 4) pickled in muriatic acid bath to etch the nickel slightly; 5) gold plate; 6) coated with clear lacquer.

SPECIAL FINISHING techniques are required in order to get gold plated die castings that have proper color match.

MULTIPLE THREADER is used by Rockwell Manufacturing Company in machining die cast aluminum gas meter bodies at its DuBois, Pa., plant. This Beckett-Harcum tapping unit cuts threads in 16 holes simultaneously, saving time and money over individual thread-cutting operations.

Rockwell is a pioneer in the use of aluminum alloy for gas meters, chosen because the light weight reduces shipping and handling costs and makes the meters easier to install. Photo, Rockwell Mfg. Co.

CUSTOM SET-UP for tapping many holes simultaneously gives maximum economy in machining these die cast aluminum bodies.

USEFUL LITERATURE CATALOGS, MANUALS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PROCESSES

Plaster Mold Castings: 144

How costs can be cut for limited runs and pilot runs through the use of plaster mold castings is told in a 12 page booklet that has been prepared by the Hale Foundry Co. A chart is given to show the quantity levels at which parts can be most economically cast in plaster molds.

Modern Die Casting Plant: 145

Handling molten zinc in a modern die casting plant is the thesis of a reprint available from Mt. Vernon Die Casting Corp., describing the company's plant facilities.

Metal Powder Parts Catalog: 146

A new 40-page catalog has just been issued by the Wakefield Bearing Corp.: one of the most complete catalogs of its kind yet issued. Compositions, densities, physical and mechanical properties, coefficients of friction and many other properties of the 23 different powder metal materials regularly fabricated are given. In addition, the catalog lists all of the standard sizes of bearings available.

MATERIALS AND EQUIPMENT

Fire-Resistant Hydraulic Fluid: 150

The Monsanto Chemical Co. has issued a 20-page booklet giving a step-by-step check list for converting a hydraulic system to Pydraul F-9. Complete details on the properties and performance of the fluid are included.

Brinell Hardness Tester: 151

A newly developed brinell hardness tester which uses colored lights to indicate relative hardness has been described in a four-page brochure put out by Steel City Testing Machines, Inc.

Molds and Dies: 152

The complete engineering, design and manufacturing facilities of Damen Tool & Engineering Co., manufacturers of molds and dies for die casting and plastic molding, are described in a brochure.

Die Casting Machine Bulletin: 153

The Hydraulic Press Mfg. Co. has issued a new bulletin, "A New Approach to Die Casting," which describes in detail the new clamp design and a newly injection end which are self-contained units of HPM die casting machines.

Protective Atmospheres: 154

An 11-page booklet has been published by General Electric Co. on protective atmospheres for heat-treating and sintering furnaces. The booklet describes and illustrates the equipment for generation of the atmospheres, gives approximate compositions and costs of producing typical gas atmospheres and a selection guide for protective atmospheres for different types of work.

Casting Wax: 155

Complete technical information has recently been published by the Petrolite Corp., Wax Div., on the casting waxes made by that company for making investment casting patterns.

How To Select A Silicone: 156

A seven-page brochure gives the necessary technical data for proper selection of the right silicone product for any applicable job. The brochure is a publication of the Dow Corning Corp.

Dry Film Lubricants: 157

The use of colloidal dispersions for dry-film lubricants is thoroughly discussed in a pamphlet available from Acheson Colloids Co. Several different dispersions and suggested applications for each are covered.

Die Casting Machines: 158

A new brochure has just been issued by The Cleveland Automatic Machine Co. describing their Universal high pressure hydraulic die casting machines. Complete physical and mechanical data, for both hot and cold chamber machines, are given.

Aluminum Bronzes: 159

The properties of 18 grades of aluminum bronze are shown in Technical Data Bulletin 15.100 available from WW Alloys, Inc. The properties listed include chemistry, tensile and yield strengths, elongation, reduction in area and hardness. Some suggested applications are also included.

High Strength Aluminum Alloy: 160

Detailed specification sheets on "Titanite", a new high strength aluminum alloy that does not require heat treatment, are available from Aluminum Smelting & Refining Co., Inc.

Plaster Release Agent: 161

A new plaster release agent that makes removal of plaster casts from wood, metal or plaster patterns and core boxes is described in an information bulletin from the Kindt-Collins Co.

FINISHING

Barrel Finishing: 165

Two new booklets on barrel finishing have been prepared by Minnesota Mining & Mfg. Co. One of them, "Barrel Finishing," explains how barrel finishing works, what types of parts can be barrel finished, and what operations barrel finishing performs. The other booklet, "Abrasive Chips and Compounds for Barrel Finishing," describes in detail the differences between various finishing chips and gives specifications for the 11 Honite compounds available for cutting, finishing and cleansing operations.

Surface Finishing Suggestions: 166

Suggestions for the solution of the problems inherent in the production of accurate surface finishing, such as lapping, honing, grinding, etc., are offered in a new four-page brochure now available from Surface Finishes, Inc.

Blast Cleaning Machines: 167

A bulletin has been published by the Pangborn Corp. describing the new, type RG Rotoblast unit

Continued on page 68

Companion tools – NOBURSINK for openly accessible hole faces and NOBUROD for outer ends of rods, tubes and bosses – provide greatly improved work quality, faster and easier than ever before. Both have low torque design permitting rapid, off-hand workpiece handling without chatter – even on large diameters. Unique design allows regrinding without special tools.

Eliminate makeshift and less efficient tools

Both NOBURSINK and NOBUROD tools work equally well on all metals. Cutting chips are freely expelled from the work area. Each tool accommodates a wide range of work size – and are furnished 90° included angle (produces 45° chamfer).

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4 **ELECTROCLEANING BRASS:** Efficient, economical cleaning without danger of tarnish.

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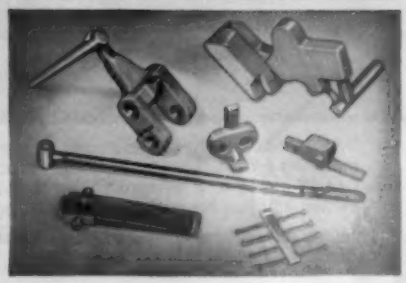
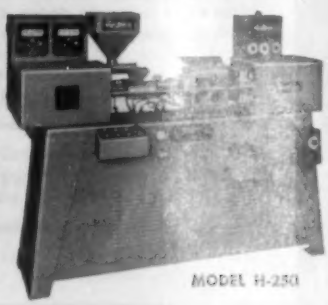
Investment Casters Prefer
VAN DORNS for
molding styrene patterns



Typical precision parts produced by investment casting, using styrene patterns molded to .003" tolerances on Van Dorn Presses.

2½ oz. Automatic and 2 oz. Semi-Automatic Presses

These injection presses feature safe, simple push-button controls. Accurate temperature regulation. Rugged, compact, quiet.



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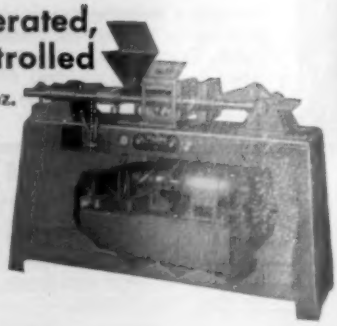
Power-Operated, Lever-Controlled Presses — 2-oz. or 1-oz. models. Have many automatic and safety features.



MODEL H-200

Plastic Grinder — grinds up waste, rejects, etc., for re-use.

Mold Bases for these presses available from stock.

Write for information on this equipment.

MODEL G-100

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For more information circle No. 63 on the Reader Service Card

Useful Literature—Cont.

for blast cleaning metal surfaces. Among the advantages claimed for the principle of controlled centrifugal blasting are: better quality, greater speed, reduced cost and increased versatility.

Finishing Die Casting with Airless Blast: 168

A new bulletin, "Finishing Die Castings With a Wheelabrator," shows the application of airless abrasive blasting for deflashing, deburring and surface preparation. The publisher is American Wheelabrator & Equipment Corp.

Phosphate Coating for Paint Base: 169

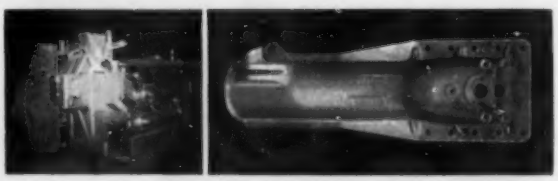
A reprint of an article on the use of phosphate conversion coatings as paint bases to lower maintenance costs is available from the Metalwash Machinery Corp.

Machining Aluminum: 170

A four-page metallurgical report on machining aluminum has been published covering such specific problems as types and shapes of tools, preparation of drills, tool materials, tapping and threading, reaming and spinning. It is available from The George Sall Metals Co.

Abrasive Grains and Powders: 171

A new 42-page booklet has been published by The Carborundum Co. covering the latest abrasive engineering recommendations. Some of the topics



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covered are: properties of abrasive grain and powders, elements of metal polishing, preparation and care of polishing wheels, general rules for good polishing.

Diamond Wheels: 172

The latest issue of Grits and Grinds, published by the Norton Co., contains information on the proper use of resinoid bonded diamond wheels when they are used dry. A comprehensive report on bonded abrasive laps is also included.

Plating Racks: 173

A new 12-page illustrated catalog describing insulated plating rack sections and insulated contact tips has been issued by Belke Mfg. Co.

Cleaning & Finishing Aluminum: 174

The cleaning and finishing of aluminum is the major subject matter of a recent issue of the Reynolds Technical Advisor, a publication of Reynolds Metals Co.

Protecting Aluminum: 175

The advantages, applications, and methods of applying Alodine 1000 for the surface protection of aluminum are given in a brochure issued by the American Chemical Paint Co.

Reduced Plating Costs: 176

How to reduce the costs of chromium plating is discussed in a leaflet distributed by United Chromium, Inc. Cost reductions of 60% in power, 40% in chromium salt, and 66% in plant capacity are described.

For more information circle No. 55 on the Reader Service Card

Typical 5 gal. pressure tank, with heated hose and heated, non-clogging gun assembly for casting wax patterns.

Of all the ways to MELT WAX for expendable patterns the MOST EFFICIENT WAY is in STA-WARM Wax pressure tanks

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CASTING WAX

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NOTE THESE ADVANTAGEOUS CHARACTERISTICS

Melting Point, Ring and Ball . . . . . 190-195°F

Solidification Point . . . . . 160-170°F

Casting or Injection Temperature . . . . . 200°F and less

Petrolite PC-13 is available for prompt shipment in 100 pound cartons, containing 8 slabs per carton. Shipments are made directly from our refinery at Kilgore, Texas. Samples and technical information are available on request. Just fill out and mail coupon at right.

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WAX DIVISION

CHRYSLER BUILDING, NEW YORK 17, NEW YORK

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ADDRESS _____

CITY & ZONE _____ STATE _____

PC 13-A

For more information circle No. 47 on the Reader Service Card

MACHINED BLANKS
continued from page 54

Due to the friction between the powder and the die walls, as well as between the powder grains, the density will always vary in the part and be highest close to the pressing surfaces, i.e. the punches, and will decrease more or less linearly towards the center. Density plotted vs. tensile strength is a straight line function which has about the same values for sponge iron and electrolytic iron. The density distribution in a part is directly indicative of the uniformity of the tensile strength within a part.

Density vs. elongation is nearly a straight line function having higher relative values for electrolytic iron than for sponge iron. Several investigations have been made to study the density distribution in pressed compacts[4,5,6,7].

More recently[8] it has been found that these earlier investigations have failed to show that there is a comparatively porous surface layer, especially on single pressed parts.

How does this fact influence the physical properties?

As Figure 1 shows, there is a slight difference in the physical properties of different layers of the single-pressed bars, but this difference is nearly eliminated in the double-pressed bars, except for the elongation, which still differs a little.

A further investigation was made to determine any difference in physical properties between parts machined from sintered blanks and parts pressed to final shape.

Two different materials were tested, viz. straight electrolytic iron powder, and electrolytic iron powder with 2% copper. From each powder, test bars of three different densities were produced in three different shapes by double pressing and double sintering techniques.

MPA test bars (.225 ± .001 wide x .200 - .250 thick), test bars with a square cross section of 10 m m x 10 m m (3.94 sq.) and large flat blanks were produced. From the latter two shapes cylindrical test bars 7 mm in diameter (.2756) were turned. The flat blanks gave two test bars each. After machining, the bars were annealed at 925 C (1697 F) for 15 minutes to relieve any cold working stresses due to machining.

Tables 1 and 2 show that there is very little difference in tensile strength and elongation between the different types of test bars in spite of the fact that they are of different shapes and that different thicknesses of metal have been machined away.

It can, therefore, be assumed

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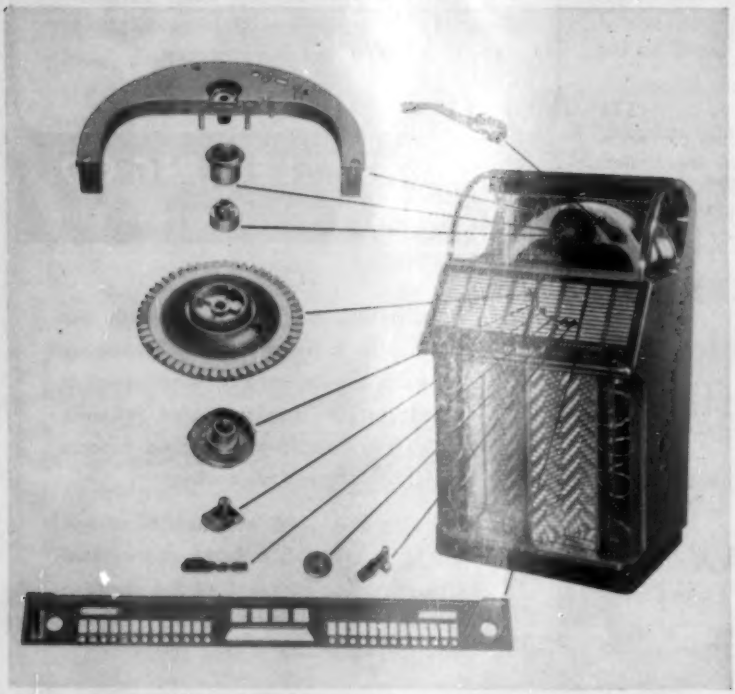

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■ To help maintain its reputation for high quality products that are competitively priced, the Wurlitzer Co. specified ACCURATE die castings. They were sure that every die casting would meet every specification. Cast to close tolerances, these castings required little or no machining, are light in weight, and are ready to use as cast.

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For more information circle No. 1 on the Reader Service Card

that there is no special influence on the mechanical properties of a sintered part, dependent on whether the part is pressed to final shape or machined from a blank or slug.

Machining Recommendations

Still more case histories could be reported from the hundreds of structural parts made at the Husqvarna factories or at licensees in Europe but those mentioned should be sufficient to show the applicability of the method of machining test pieces from sintered blanks.

The machining of porous powder metal parts has recently been described[9]. The figures given are applicable also to dense parts, but the cutting speeds can be raised.

At the Husqvarna works the cutting speed for milling with HSS-cutters varies from 150 to 270 sfpm. The feeds are about 0.002 in. for finishing and 0.005 in. for roughing.

Coolants for milling are oil emulsions containing $NaNO_2$ and H_3BO_3. For turning with carbide tools the same cutting angles as for mild steel are used. Cutting speeds up to 650 sfpm and feeds up to 0.030 inches per revolution have been used, but for finishing feeds about 0.005 in.p.r. are better.

Drilling speeds are about 100 sfpm or more with HSS. The feeds may be somewhat higher than those given in the paper of Langhammer. A suitable coolant for drilling and tapping is a mixture of 70-80 percent kerosene and 20-30 percent rape oil.

Three important rules for machining sintered steels are given in the mentioned article and ought to be cited: Machining powder-metals parts is easy, if:

a) Tools are dead sharp
b) Clearance and cutting angels are correct
c) High speeds and light feeds are used.

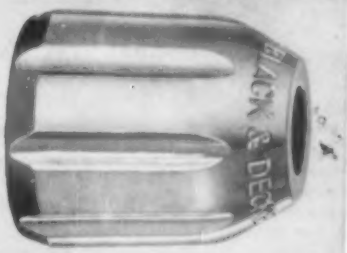
For grinding the following figures can be given:

Continued on next page

now you can get this brilliant finish directly on zinc die castings!

PART AS CAST

No electroplating--no mechanical finishing!



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brightens zinc die castings by chemical polishing, protects against corrosion

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CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for FREE PROCESSING for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. *IMPORTANT: when you give us samples for test processing, please be sure to identify the alloy used.*

Iridite is approved under government specifications

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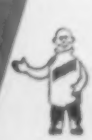

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It is now possible to greatly reduce down-time by using Auto-Diesel Hardened Steel Plunger Rings. A SET WILL GIVE YOU OVER 100,000 SHOTS. They last for MONTHS instead of HOURS. Many plants have set new and outstanding performance records. (Names supplied upon request). They are made of cast iron, dieloy cast iron or hardened steel. If you cast zinc parts or operate die casting machines, it will pay in dollars and cents, to investigate. Write today.

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Here is a QUALITY ring, precision made to give you satisfactory service. Can make fast delivery on small runs and make ATTRACTIVE PRICES. Made of high grade wear resisting iron in sizes from 1½" to 4" by ⅞". Write today for prices.

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Sintered Steel—Cont.

1) Grinding of outside diameters

Wheel quality:

Norton Alundum 57A46-L5VBE or equivalent

or:

Norton Alundum 57A60-K5VBE or equivalent

2) Surface grinding:

Wheel quality:

Norton Alundum 57A46-J8VBE or equivalent

3) Hole grinding:

Wheel quality:

Norton Alundum 57A60-K8VBE or equivalent

Cutting speed and feeds depending on the stability of the machine concerned and the desired surface finish.

References:

1 W. Doelker and H. Harrison, Paper presented at Metal Powder Association Meeting, April 1953.
2 G. Zapf, Precision Metal Molding, April 1954.
3 O. Ballhausen, Archiv fur Eisenhuttenwesen 22 (1951) Heft 5/6.
4 H. Unckel, Arch, Eisenhuttenwesen 18 (1944-45) pages 125-130, 161-167.
5 R. P. Seelig and J. Wulff, Trans. Am. Inst. Mining Met. Engrs. 166, 492 (1946).
6 F. V. Lenel, A. Compressibility test for Metal Powders (1949) May ASTM Bull. pages 52-56.
7 A. Squire, Watertown Arsenal Laboratory Report Nr. WAL 671/23 (1945).
8 I. Ljungberg, IVA FKO-Meddelander No. 16 (1954).
9 A. J. Langhammer and Philip Glick, American Machinist, April 26, 1954.

GLIDDEN PROMOTES TWO

Two appointments to important new posts in the Chemicals-Pigments-Metals Division of The Glidden Company have been announced by John P. Ruth, vice president and general manager of the division.

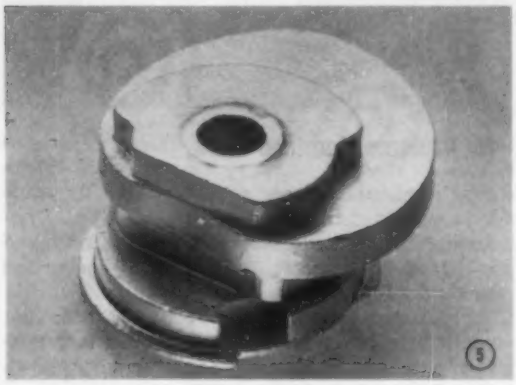
Ralph B. Quelos becomes eastern sales manager of the division with headquarters in Baltimore, and James C. Rankin assumes duties as Central sales manager with headquarters in St. Louis. Both changes were effective on January 1.

A graduate of Case Institute of Technology, Mr. Quelos began his career with Glidden 21 years ago. Mr. Rankin, a native of Cleveland where he attended Fenn College, has been with the Glidden Company for 12 years.

RAPID TOOL WRITE-OFF
continued from page 41

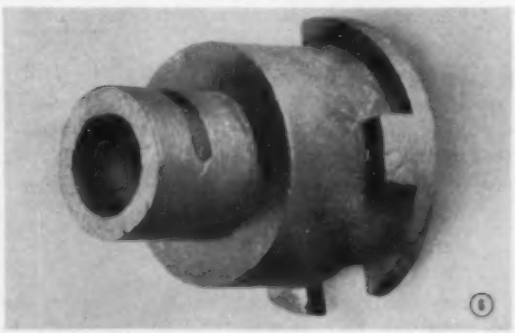
number to be stamped on the trip card. A similar part was formerly a sand casting that had to be machined all over.

When the design was changed, investment casting was specified as the manufacturing method. Except to mill the back edges to meet dimensional requirements, and to engrave the key number, no other machining is required.



5. Five Cams — One Piece The complex cam shown is a single investment casting which replaces a previously brazed and riveted assembly of five stampings. The piece is cast in 1020 steel and used unhardened, needing only to have the bore reamed to size. On this piece, the camming surfaces are held to a total dimensional variation of 0.005 at any point measured from the center of the bore. The angular relationship of the five cams to each other is important and must be held to a total variation of ½ degree or less.

By converting to an investment casting, a saving of about 60 percent per piece was accomplished plus an original tooling saving of over $500 on a production of 500 pieces per year.



6. Replaces Machined Bar An 85-5-5-5 bronze is used to cast this key cylinder. Except for reaming the bore, cleaning up a counter-bore and facing one

SHELL MOLDED CASTINGS

GIVE *Smooth* AS-CAST SURFACES

INSTEAD OF

IN ANY ALLOY... *MAGNESIUM*
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COPPER
BRASSES
BRONZES
CAST IRON
STEEL (All Alloys)

Any alloy that can be cast in sand can be shell molded—and with far better as-cast finish. For example, as low as 60 rms on 410 steel. What's more, uniformly close tolerances in the range ±0.003 to ±0.005 can be maintained under normal conditions. It is only good judgment to consult with us on each design to be shell molded.

These advantages offer big cost savings in machine finishing. So check now on shell molded castings for your parts. And when you do, check with Shell Castings Inc. One of our foundries in strategic industrial areas is sure to be near you. Contact Shell Castings, Inc., P.O. Box 782, Erie, Pa. We'll be glad to consult with you . . . at no obligation, of course.

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The LITEMETAL BULLETIN

PLATING ALUMINUM DIE CASTINGS REQUIRES SPECIAL TECHNIQUES

Close Co-Operation Between The Die Caster And Plater Is Essential To Successfully Give Aluminum Die Castings Fine, Smooth Finishes

Commercial plating of the light metals is relatively new. As in the zinc die casting industry, aluminum die casters have had to virtually re-learn their art in order to produce castings of sufficiently high quality to provide flawless plated surfaces.

Litemetal has proved itself capable of producing plating quality castings, for the Kitchen-Quip Saladmaster (illustrated), in large quantities. Working closely with one of the most successful platers of aluminum, Litemetal has developed the high quality standards and specialized techniques necessary to make plating of this die cast product practical.

Because of its lightness and lower cost, die cast aluminum was chosen for the body, handle and legs of the Saladmaster. Virtual elimination of machining and consequent labor savings effected, plus reduced shipping costs, made this choice most practical. The product's required appearance was attained with chromium plate. Production rates now approach 1,000 sets per day and will increase greatly as soon as plating facilities can be expanded.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

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A DIVISION OF HAYES INDUSTRIES

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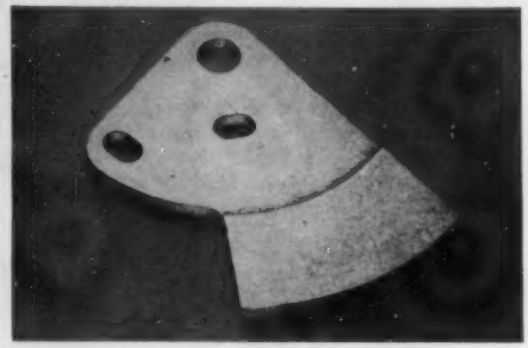
PLANT AND EXECUTIVE OFFICES

For more information circle No. 35 on the Reader Service Card

shoulder, no machining is needed. In contrast, the original part was fully machined from bar stock by both screw machine and milling machine operations. On a production of about 500 pieces per year, a per-piece saving of 60 percent and tooling saving of $350 have been shown.



7. Replaces Machined Plate This investment cast blank for a gear segment replaces a part previously made by machining from ¼ inch thick plate. After casting in 1020 steel, the radial edge is machined and teeth cut into it. This edge is carburized and induction hardened.

Production is at a rate of about 150 pieces per year. Investment casting has reduced manufacturing costs by at least 50 percent and has shown a tooling saving of about $100.

CAST IRON TO POWDERED IRON
continued from page 37

been no trouble at any time with this welding operation. In fact, it is doubtful if in the early usage of powdered metal parts, the welders were even aware that the parts were not some sort of a wrought material.

The change, then from machined cast iron to powdered iron parts, has . . .

- Simplified design of the surveyor,
- Eliminated all assembly operations except a simple welding job,
- Eliminated all machining except to drill two holes for drive pins,
- Provided a self-lubricating unit with considerably longer life,
- Made a unit that is much less expensive when ready to mount on the drill,
- Permitted reduction in overall size by one-third.

Since two sizes of grain drills are made, the 16-7 and the 13-7, it was formerly necessary to have separate surveyors, because the acreage dial was a portion of one of the castings. Now, by changing inexpensive dials, the same basic unit can be used on both sizes, reducing inventories.

PRODUCT NEWS AND DEVELOPMENTS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

VERTICAL & RADIAL DRILLING

. . . now done simultaneously

By the simple modification of a machine for drilling radial holes, one of the standard machines can now be used to drill both radial and vertical holes simultaneously. The change has been accomplished by incorporating in the machine vertical bracket which holds an automatic drilling unit with a multiple head. With this arrangement, five radial and two vertical holes can be drilled at the same time.

While the machine is one of a standard line, the great variety of ways in which the drilling units may be arranged enables it to take the place of special machines for many different drilling operations.

The drilling units may be positioned around the table in any position required by the part being drilled, and they may also be moved endwise on riser plates. By the addition of tapping units, the machine becomes a tapping device of wide versatility.

Cevro-Nelson Co.
For more information, circle No. 197 on the Reader Service Card

---

NEW DIMPLED SURFACE

. . . aids belt discharge

By incorporating a dimpled surface on a hinged steel conveyor belt, the discharge problems experienced with flat surfaced belts handling small, flat, light-gauge metal parts or scrap are greatly reduced.

The dimpled design of the belt assures drip off of flat pieces and scrap, even though covered with oil or compound or slightly magnetized, when the belt passes over the discharge end of the conveyor. Standard flat-surfaced belts do not provide this positive shedding action.

Users of the dimpled belt report greatly improved discharge characteristics. The new belt, for example, is handling small motor stator lamination knockouts and light-gauge automotive bushings with excellent results.

May-Fran Engineering, Inc.
For more information, circle No. 196 on the Reader Service Card

---

VACUUM GAUGE

. . . has wide range on single scale

A new model vacuum gauge which indicates pressures from 1 micron to 10 millimeters of mercury has been introduced. The pressure is read from a single four decade logarithmic scale; no switching from one range to another is necessary.

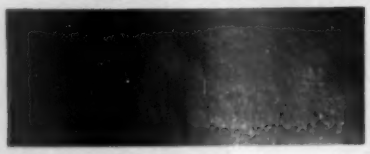
The gauge is small, rugged, and portable, requiring only a source of 110 volt 60 cycle current. Like other vacuum gauges made by the same company, the model 515 gauge utilizes a sealed radium source; this emits alpha particles and produces ionized gas molecules which are collected on a plate to produce a current indicating directly the measured pressure.

The gauge cannot be damaged by exposure to atmospheric pressure because the ion source operates at room temperature and at zero potential.

Continued on page 76

For more information circle No. 57 on the Reader Service Card

Better Alloys=Better Castings



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PRODUCERS OF: *Aluminum, Brass and Bronze, and Zinc Ingot; Hardeners, Z-shot and bar for Zamak production, Salloy, Special Alloys.*

"Better Alloys for Better Castings Thru Creative Metallurgy"

Die Castings by MILWAUKEE

...for Extra Values at No Extra Cost!

A pioneer in its field, Milwaukee offers you the experience and knowledge gained in helping others for more than 40 years, to realize the full benefits of the die casting process. In its modern plant, it offers you the most advanced facilities for the production of zinc and aluminum die castings. These extra values which cost you no more, can help you build extra values into your product, too.

We operate under the Certified Zinc Plan of the American Die Casting Institute, Inc.

MILWAUKEE DIE CASTING COMPANY

4146 N. HOLTON STREET · MILWAUKEE 12, WISCONSIN

Established 1909

For more information circle No. 39 on the Reader Service Card

Gauges of this type are said to be less susceptible to contamination than are hot element vacuum gages.

Norasco Equipment Corp.
For more information, circle No. 200 on the Reader Service Card

---

THREAD BROACH

. . . reduces tapping costs

Designed to operate at speeds of from three to six times the normal tapping speeds used for conventional taps, a newly developed thread broach is reported to assure substantial cost reductions in thread cutting operations. Savings in time and labor as high as 75% are claimed.

The tools are made from high speed steel and are said to require less than half the power required for ordinary taps. The design is such that the tap produces a solid chip in one piece. The broaching action, it is claimed, increases tap life materially. No special tools or fixtures are required for the use of the new taps.

Shearcut Tool Co.
For more information, circle No. 199 on the Reader Service Card

---

FOR SELECTIVE TUMBLING

. . . drum has three covers

For parts that require selective tumbling, one manufacturer has perfected a new drum with three removable covers for use on a twin barrel finisher.

This is said to be an entirely new idea which reduces the cost of rack-tumbling as well as speeds up the operation. Instead of using a specially built barrel with specially built-in rack, a standard barrel with three openings and standard plain covers is used to which the customer adapts his own racking fixtures.

By using extra covers a wide variety of parts can be tumbled in the same barrel. Extra covers ready for quick change materially reduces down time.

Rampo Mfg. Co.
For more information, circle No. 198 on the Reader Service Card

NEW MAINTENANCE SERVICE

. . . offered die casters

Announcement has recently been made of a new service that is available to owners of die casting machines. Shot sleeves, metal wells or liners from 2" to 4" inside diameter and up to 14" long that have become worn or eroded can be reworked to the next larger size. Up to ¼" stock removal on the bore can be achieved and if required the reworked part is nitrided and polished after hardening.

Prices and full information on this maintenance service are available. Special introductory rates are offered.

Martin Grinding & Machine Works, Inc.
For more information, circle No. 201 on the Reader Service Card

BARREL FINISHING COMPOUND

. . . for die castings

A new barrel finishing compound designed to produce especially smooth finishes on light metal die castings has recently been announced. The new compound is recommended for use on zinc, aluminum and other light metal alloys.

Light machine marks can be removed and leave an extremely fine surface finish, with a minimum of stock removal, avoiding deep scratches and exposure of porosity in castings.

Minnesota Mining & Mfg. Co.
For more information, circle No. 203 on the Reader Service Card

BERYLLIUM COPPER
continued from page 42

steel hobs were made of the two lock part shapes; but, instead of pressing the hobs into steel, beryllium copper was poured around them with pressure then applied.

Depending upon the shape of the cavity, a round or rectangular chase is used to contain the molten beryllium copper. The hob is screwed into place at the bottom of this container and heated, after which the beryllium copper is poured around it. By using a hobbing press, a piston which fits the chase rather closely is forced down to compress the metal. The metal is allowed to cool while the piston is still in the down position. The final step is to back off the ram and disassemble the set up to remove the cavity casting.

Since much less pressure is required in this method of hobbing, there was no tendency for the cam-shaped legs on the hobs to sheer off or bend, and the beryllium copper cavities were formed with no difficulty and a minimum of expense.

To summarize our experience and present attitude toward the

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use of beryllium copper, the greatest advantage appears to be the lesser force required in this process of forming a cavity. This means that there is less chance of damaging the hobs and that delicate, asymmetrical or built-up hobs, which were previously impractical, except possibly at vastly increased expense, can be used.

In addition, the cavity follows the hob much more faithfully so that the problem of cavity walls moving away from the hob is eliminated. With beryllium copper there is no longer any difficulty in making the cavity metal flow upward during hobbing as required for a convex-shaped die casting.

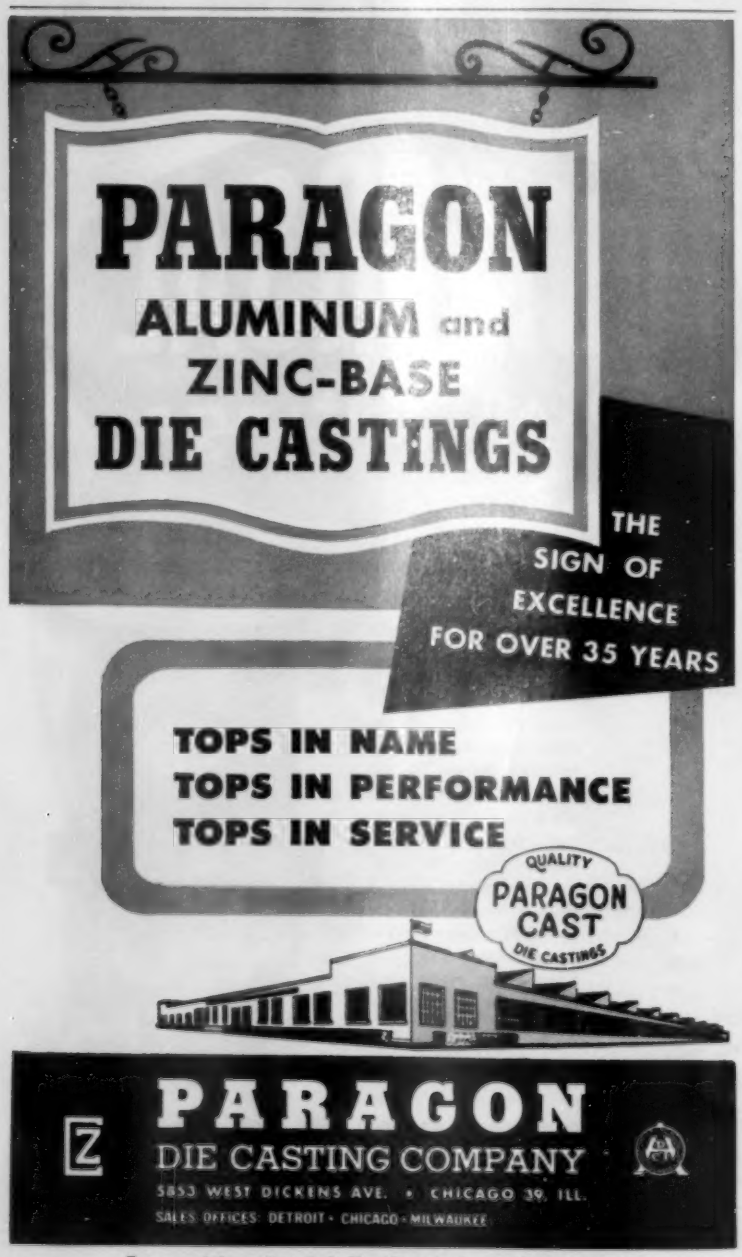
Another advantage is that there is less metal to remove from the outside of the cavity because it is cast closer to the desired shape. Also, the cavity can be heat treated so as to be hard all the way through. This compares favorably with merely case hardening a cavity which was often all that could be done because of complex cavities that required soft hobbing iron rather than hardenable tool steel.

One word of caution is necessary. Some die casters have reported poor experience with beryllium copper because of erosion due to the action of the molten zinc alloy passing through the cavity. For this reason, it has sometimes been said that beryllium copper cavities, despite their notable cost savings, are impractical because they do not result in a permanent mold.

In fact, cases have been known of expensive molds, portions of which vanished after a few hours operation!

We, too, have had this difficulty, but here is how we have overcome it. Erosion is a function of the temperature of the zinc alloy, the amount of molten metal flowing over given parts of a cavity, its speed and the degree of impingement of molten metal upon certain parts of the cavities or exposed cores. To prevent this, hard chromium plate is applied to the cavity before it is used. While it is difficult to throw this plating down into the depths of a cavity, with the result that most of it will adhere to the parting plane of the mold, it will be found that this is ordinarily effective enough, since the conditions of rapid flow, temperature, etc. are mainly met in or near the gate and runner at the parting plane. Other than this, our practice is to avoid direct impingement of molten metal on a salient portion of beryllium copper.

If these simple precautions are followed, these cavities will last for at least 500,000-600,000 shots, and probably as long as the equivalent steel cavity. This, coupled with the ease of fabrication, results in significant cost reductions in that most troublesome of die casting problems, the expense of tooling.



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NEWS OF INDUSTRY AND ASSOCIATIONS

TED OPERHALL ELECTED TO HEAD MISCO PRECISION

R. D. Colburn has announced that the Board of Directors of the Iowa-Michigan Corp. elected Ted Operhall to the office of president of the Misco Precision Casting Co.

Ted Operhall

Mr. Operhall succeeds Edgar D. Flintermann, who has been president for the last several years, and who will be associated with The Misco Corp.

Mr. Operhall joined the company in September, 1948, as project engineer, and subsequently held positions of chief engineer, assistant manager, and vice president and general manager.

Misco operates two plants, one in Whitehall, Mich., and one in Detroit, both engaged in the production of component parts for the jet engine field.

Mr. Operhall entered the field of investment casting with the Ford Motor Co., and subsequently was responsible for similar activities with the Bendix Aviation Corp. research laboratories before joining Michigan Steel Casting Co. in 1948.

He currently is president of the Investment Casting Institute, a trade association developed to advance the field of investment castings, and is active on many committee functions relating to this activity.

LESTER CASTINGS OPENS NEW DIE CASTING PLANT

Opening the new plant of Lester Castings, Inc., in Bedford Heights, Ohio, culminates 18 years of experience in the die casting industry for Thomas J. Lester, president and chief engineer of the company.

Mr. Lester's father, Nathan Lester, in 1933 organized the Lester Engineering Company, manufacturers of die casting machinery. Young Lester grew up in the business.

The new Lester plant covers 15,000 square feet on a five-acre plot at the corner of Cannon and Aurora Roads and contains

Continued on page 86

ARTHUR E. HILLS BECOMES MANUFACTURERS' REP.

Arthur E. Hills announces that effective January 15, he is establishing as a manufacturers' representative covering Northern Ohio, with headquarters at 2176 Edgerton Rd., Cleveland 18, Ohio.

Mr. Hills has 12 years tooling and production engineering in general manufacturing, plus 10 years in the die casting field,

A. E. Hills

most recently as sales manager for Cleveland Hardware & Forging Company's Die Casting Division.

He will represent Paramount Die Casting Company of St. Joseph, Mich. for zinc, aluminum and magnesium die castings; Michigan Wheel Company of Grand Rapids for aluminum permanent mold castings; and Midwest Foundry Co., Coldwater, Mich., for investment castings and shell mold castings.

REPRESENT HPM

The Hydraulic Press Manufacturing Company of Mt. Gilead, Ohio announces the appointment of the Norman Engineering Co., 2115 W. Marquette Road, Chicago 36, Ill., as representatives for their Hydraulic Power Division line.

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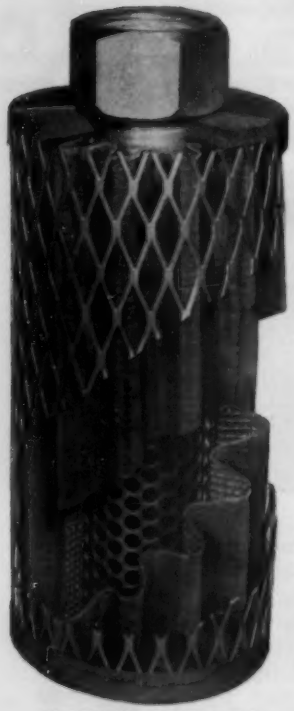

SUMP TYPE (Cutaway)

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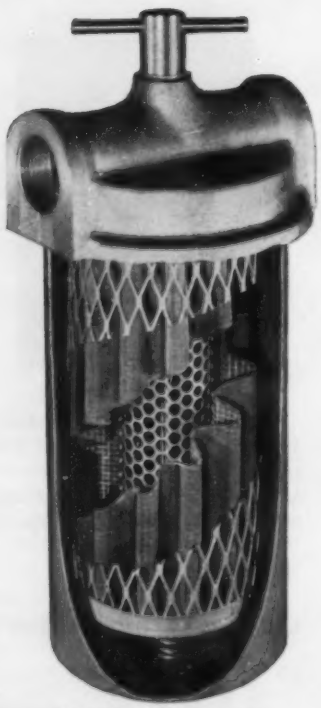

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- ☐ Data on filters for non-flammable hydraulic fluids

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Fire Resistant Hydraulic Fluids For Die Casting- Part 3

Two preceding articles in this series were discussions of Aqueous Base Hydraulic Fluids by W. H. Millett, and Non-Aqueous Base Hydraulic Fluids by John S. Harris. Here, now, is the prepared commentary on the first two papers.

Aqueous Base

By C. R. SCHMITT
E. F. Houghton & Co.

Fire Resistance: Particularly interesting was Dr. Millett's reference to the "non-flammable" designation given to fluids currently used for hazardous applications. It is well to consider the relative fire resistant qualities of the various types of fluids used for this purpose.

Insurance underwriters use the term "Fire Resistant" to correctly define these fluids since they find that all fluids, except perhaps water itself, will burn if exposed to the right conditions. However, for the conditions under which aqueous base fluids are to be used we can assure you that they will protect your equipment and personnel from injury due to fire.

Questions have been raised as to the flammability of the aqueous fluids when all the water has been evaporated. Tests have been run under such conditions and the result has been that the base materials do not readily support combustion. In fact, they burn with difficulty and not at all like the explosive nature of the flammable petroleum fluids.

Viscosity: The figures on viscosity at low temperatures are indicative of performance where fluids are used in equipment exposed to variations in ambient temperatures. For example, a common practice is to start up a machine early Monday morning and let it run "up to temperature" before beginning production runs. Fluids which thicken up unduly at reduced temperatures do not feed properly into the suction side of the pump in

Continued on page 83

Non-Aqueous Base

By W. C. GOODWINE
Celanese Corporation of America

Mr. Harris is to be commended upon a fine presentation of fact concerning the synthetic hydraulic fluids. I cannot say "non-flammable fluids" since we, at Celanese must also agree with the scientific fact—these several fluids are not truly non-flammable but are fire resistant, safety fluids.

Fire-resistance: In general, the synthetic fluids represented by Lindol HF, Araclor, Pydraul and the Cellulubes are inherently fire resistant with a true auto ignition point over 1200 F.

Viscosity: While it is agreed that viscosity index is important in the overall considerations of the lubrication engineer, it is frequently impossible to build every desirable property into a specific fluid. The variation in viscosity most important for consideration lies between cold start up and maximum operating temperatures—a relatively narrow range of temperature. The effective VI in this narrow range is slight. The important consideration therefore to the die casting operator is the determination of the viscosity which satisfies his demand for easy start up and maximum shot efficiency in the operating temperature range. It is our opinion that a controlled viscosity fluid satisfying this requirement is desirable.

Lubrication: While test data indicate that the synthetics outperform ever premium grade oils—no one synthetic fluid can answer all of the demands of industrial usage.

Celanese prefers to use Shell 4 Ball data as a norm—following the laboratory test with operation of commercial unit pref-

Continued on next page

erably under the supervision of the equipment manufacturer.

Non-corrosiveness: No evidence of corrosion has been noted in the field operation of the synthetic fire resistant fluids to our knowledge.

Stability: The heat stability of the synthetic fire resistant fluids in general is excellent. They are resistant to oxidation at the normal temperatures encountered in hydraulic systems.

Resistance to Moisture: "Coke Bottle" data under specification MIL-F-7100 confirm previous tests. No hydrolysis was noted in other types of laboratory investigation of this specific property.

Compatibility: The synthetics as a class are excellent solvents for many types of gasket, packing and hosing materials as well as pipe joint compounds and paints. This is easily explained since these synthetic fluids belong to the general class of plasticizers or processing aids often used in making these very same materials.

We have long recognized the need for cooperative work with both the equipment manufacturers and the suppliers of maintenance items. The cooperation of the manufacturers of gasket, packing and hosing materials is deeply appreciated. With the introduction of the non-aqueous synthetic fluids, some few equipment manufacturers ran limited tests but were not overly impressed with the results because of excessive leakage despite the safety features inherent in the use of the fluids.

As the use of these fluids became more widespread in the die casting industry, the equipment manufacturer became cognizant of the need for closer study of the synthetics. As a result of the teamwork developed among these several groups, better fluids, better equipment, and better maintenance supplies are now available to the die casting field. Seals suitable for any one of the several non-aqueous types can be used with the other fluids under consideration—Lindol HF, Araclor, Pydraul and the Cellulubes.

Toxicity: An important consideration in the evaluation of any product involves the possibilities of toxic symptoms in personnel using such product. The synthetic fluids in general can be considered of low toxicity based on past and current industrial usage. Improper handling of any industrial product can cause trouble. We recommend the following points as normal safety measures—

1. Operators should be equipped with glasses or goggles when engaged either in actual machine operation or maintenance procedures.
2. Personal hygiene insists that operators wash their hands with soap and water thoroughly before eating to avoid accidental ingestion.
3. Prolonged skin contact with any of the synthetic fluids is to be avoided to prevent dermatitis, chloracne lesions or other skin irritation.
4. Adequate ventilation is recommended.

Synthetic fluids should be closely scrutinized since those with an unusually low vapor pressure substantially reduce the problem of vapor phase toxicity.

Service Life and Cost: These fire resistant synthetic fluids are more expensive than petroleum oils—but they represent insurance against injury to trained highly paid personnel and damage to expensive equipment, loss of production time and that of the die caster's customer. No matter how complete a system of mechanical safeguard is employed, accidents can and do happen. The fire resistant fluids minimize the hazards to personnel, equipment and the prospect of costly "down time" when the accident does happen.

Another point to consider with particular reference to the synthetic fire resistant fluids is that the fluid does not "wear out". Control of leakage is therefore again important to insure benefit from this characteristic.

In general, the fluids under consideration can be reclaimed and reused time and again with ease and a bit of good housekeeping precaution. They should not be contaminated or mixed with other oils, fluids or lubricants. Water can usually be removed by decantation and simple mechanical filtration is sufficient although the use of certain filter aids such as Magnesol or Fuller's Earth is recommended with specific products.

Summary: The die casting field represents a dynamic and challenging market for even better safety fluids. The equipment manufacturers recognize the need for design improvements in the maintenance of optimum efficiency of die casting operation, the maintenance products supplier feels the demand for improved gaskets, packing, hose and pipe joint compounds, to satisfy your demands for continued progress in the die casting field. In this field, the independent die caster is truly a pioneer.

The safe experience of independent die casters with these non-aqueous fire resistant fluids as well as the aqueous types has focused the attention of other industries employing hydraulic operations where the problem of fire hazard is also ever present.

Aqueous Hydraulic Fluid—Cont.

use and injury due to starvation can result.

The aqueous fluids do not require such run-in periods due to their very high viscosity indices (150).

Common practice in the field of industrial hydraulics is to specify that petroleum hydraulic oils have a minimum viscosity index of 80. However, it can be seen that the water base fluids are much superior in this respect.

Wear Resistance and Fluid Delivery: In addition to Dr. Millett's remarks on performance in pumps, we would like to carry his reference to pressures a step further. While pressure does undoubtedly have an effect on performance, it is the combination of pressure *and* volume which is the problem. All of the fluids, aqueous and non-aqueous, are high gravity fluids and today's pumps are designed for the lower gravity petroleum oils.

Thus, porting design in pumps is now becoming a factor in order to reduce fluid velocities within the pump itself and eliminate turbulence of the incoming fluid. Failures which have been termed "wear failures" are now suspected to be tied in with unsatisfactory fluid flow within the pump.

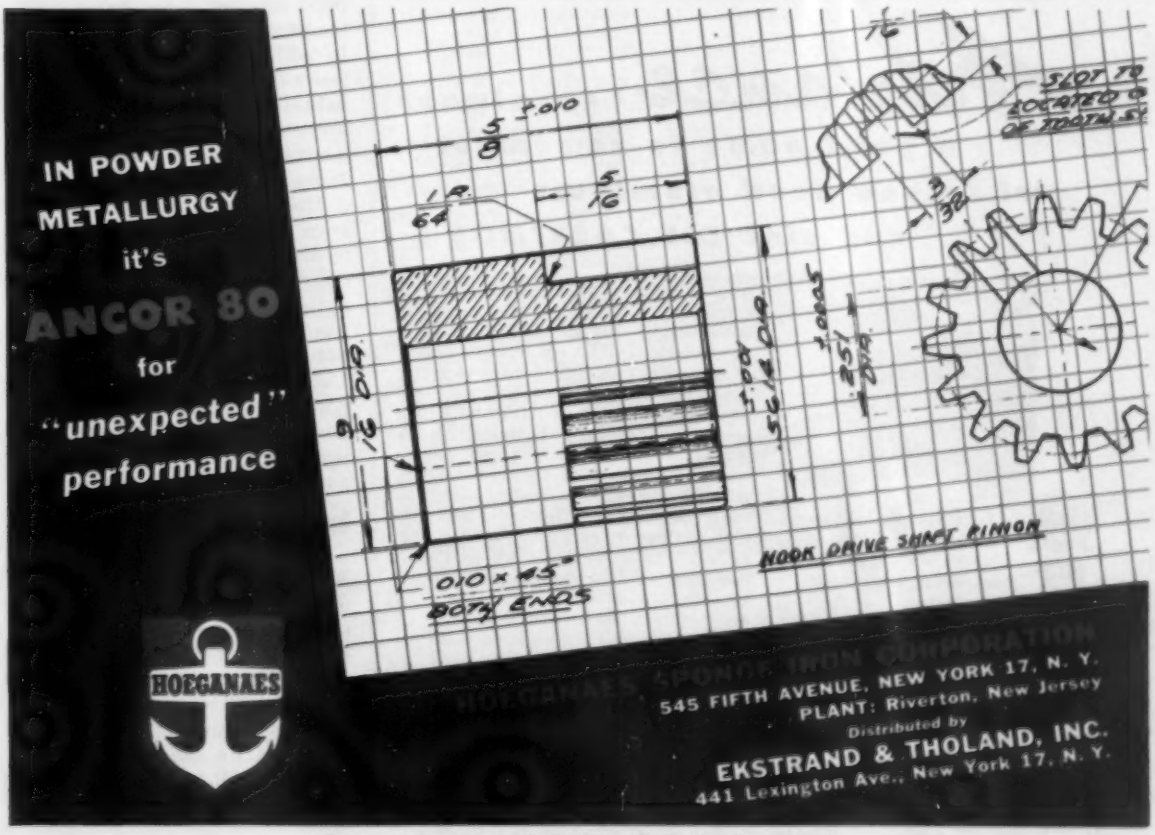
One pump manufacturer has already recognized this fact and is in the process of re-designing inlet and outlet fluid ports in order to permit streamlined fluid flow at all pressures. Under proper fluid flow conditions all known fire resistant fluids have entirely adequate lubricity to protect pump surfaces.

Another point in connection with wear resistance is the constant realization that we are dealing with new and different fluids than those which we are familiar with, namely petroleum oils.

Some of the things, we learn, are surprising and unexpected. It is not at all difficult to resort to the use of laboratory film strength testers to show the superiority of the aqueous base fluids over petroleum oil. For example, on one common film strength machine, the Cornell Tester, petroleum hydraulic oil of high quality will withstand a loading of 500 to 750 pounds before seizure takes place.

An aqueous base fluid of the same viscosity, under the same conditions will withstand loading of 2,750 pounds before noisy operation occurs and will permit loading up to 4,000 with accompanying erratic operation. Tests are not continued to failure beyond that point.

Another test in hydraulic pumps showed that where antifriction bearings were changed to bronze sleeve bearings, the aqueous base fluid gave phenomenal protection against wear and the coefficient of friction was extremely low. In fact, the engineer in charge of the test voiced the opinion that if all pumps could be so equipped



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and run with the aqueous fluid, pump life could be increased ten fold since the life of the anti-friction bearing now determines the time between pump overhauls.

Of interest here is the fact that petroleum hydraulic oil will not satisfactorily lubricate the sleeve bearing but does a good job in the anti-friction bearing.

Because of these conflicting test results we must draw certain conclusions.

a. Any number of lubrication and film strength tests can be run to show the protective superiority of both aqueous and, in fact, non-aqueous fluids over petroleum hydraulic oil.

b. Everyone is in agreement that, in general, petroleum oils are operating in a satisfactory manner in hydraulic pumps and systems.

c. Therefore, something other than lubricity or film strength or extreme pressure properties accounts for the cases where troubles with the fire resistant fluids have been encountered.

In our opinion, the majority of these troubles must be traceable to inadequate preparation of machines prior to changeover to these fluids or to mechanical deficiencies in the system causing interruption of smooth fluid flow so necessary to trouble-free operation.

If it were simply a question of film strength or lubricity, then it would be a matter of selecting additives from the many types now available to enhance such properties. However, as has been shown, it is not this simple and therefore the speaker can see little reason for increasing the cost of the final product through the use of such additives in order to gain what would be strictly a laboratory advantage.

Packing and Seals

A comment may be in order here only to emphasize the fact that aqueous fluids have little or no effect on the packings and seals used in hydraulic circuits. Such materials as Teflon, Kel-F, silicone rubbers and the like are not included because they are relatively expensive and used only where the temperatures or type of fluid requires a special packing material.

Vapor Pressure

The so-called problem of maintaining the water content of aqueous fluids is not as serious as it appears. In order to present the facts as forthrightly as possible to prospective users, the marketers of aqueous fluids may have made it sound more formidable than it really is.

A recommended top temperature of 150 F. has been set as a conservative limit. No hardship is suggested since few systems operate in excess of this temperature with hydraulic oil. In addition, the aqueous base fluids have higher specific heat values and also conduct heat away faster so that lower temperatures prevail than with oil formerly in use.

The Joint Industry Conference, in setting up standards for hydraulic equipment, established 130 F. as a top limit for oil at the pump inlet under normal, continuous operating conditions.

As a general rule, system temperatures average 125 F. or less when using aqueous fluids and water additions, as Dr. Millett points out, are quite small.

Installations

We are in agreement with Dr. Millett as to the importance of proper cleaning and inspection of systems before installing fire resistant fluids. Emphasis should be placed upon the fact that oil will separate from and float upon the surface of aqueous fluids. It should be removed, as suggested, by skimming because it could interfere with the

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Aqueous Hydraulic Fluid—Cont.

escape of air or gas bubbles from the fluid by forming a restricting film on the fluid surface.

Regarding flushing of systems prior to the installation of aqueous fluids, many users have proceeded to use the aqueous fluid itself as a flushing agent. This is particularly so where several machines are to be converted.

In such instances, the fluid is drained into a drum where the solids are permitted to settle out. The oil will rise to the surface. The drum is placed on its side with the bung at five o'clock and clean, separated fluid is drawn off until oil begins to show. The balance is discarded, the clean fluid re-used for the next machine flush.

In conclusion synthetic fire resistant fluids are entering a field where machines, pumps and component parts are designed for use with petroleum oil. The transition will require some changes in present design of equipment as well as emphasis on the user's care in installing the initial fluid before successful usage will be assured.

The suppliers of the fluids must, in turn, spare no effort or justifiable expense to improve upon both products and methods in order to bring fire resistant fluid service to a high peak of satisfaction.

OPPORTUNITIES

A LEADING FABRICATOR in the powdered metal industry is now considering representation in the Philadelphia, Pittsburgh, Baltimore, Birmingham, Alabama and Michigan (exclusive metropolitan Detroit) areas. Interested parties are requested to submit information concerning present territory covered, educational background and current lines of products handled to the attention of the General Sales Manager, The Yale & Towne Manufacturing Company, Powdered Metal Products Division, 9335 West Belmont Avenue, Franklin Park, Illinois.

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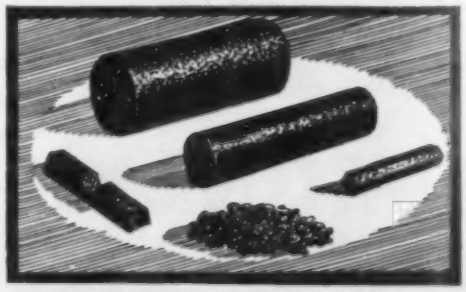

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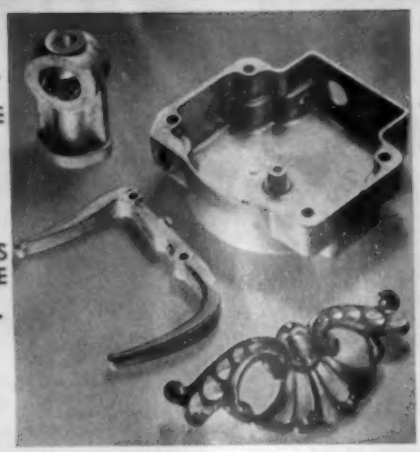

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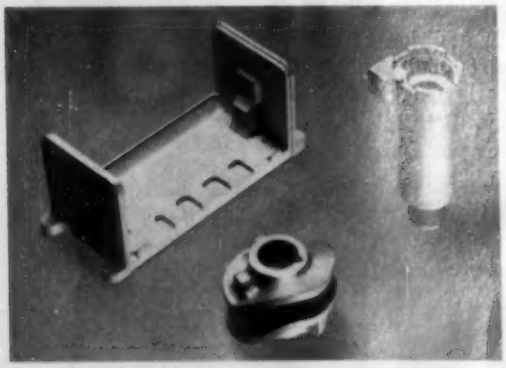

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INDUSTRY NEWS
continued from page 79

all the latest equipment and facilities for engineering, tooling and die casting of aluminum and zinc.

The Lester company's management consists of: Joseph P. Kish, treasurer and plant manager; Clyde F. Luke, superintendent, tool and die department; Sam Mazzo, superintendent, trimming, finishing and assembly department; Robert G. Gomillion, director of quality control; Chester G. Pearson, night superintendent; Maurice J. Auerbach, sales manager.

ALCALOY ACQUIRES PROPERTY FOR EXPANSION

Alcaloy Inc., one of the leading companies associated with Dickey Industries, Cleveland, is planning further expansion in Trenton, N. J. According to James W. Dickey, president, it has purchased land and buildings at Schenk and West Third streets in that city from Republic Steel Corp., and will proceed with a long-range program of improvement in equipment and capacity.

Alcaloy is an alloy of refined aluminum and copper, having non - sparking, non - magnetic and corrosion-resistant properties, combined with the hardness of steel. It is now used extensively for safety tools and equipment safeguards against fire and explosive hazards.

Alcaloy is a prime contractor for Navy castings, and in addition to the alloy it manufactures brass and bronze permanent-mold castings.

AMCO REPRESENTS HARPER

Appointment of the Amco Furnace Contractors Ltd., 169 Eastern Ave., Toronto, Ont., as distributors is announced by the Harper Electric Furnace Corp., 39 River St., Buffalo, N. Y., manufacturers of high temperature electric furnaces and kilns.

NEWLY ASSOCIATED FOUNDRIES OFFER SHELL MOLDED CASTINGS

Shell Castings, Inc. designates a newly formed group of modern foundries devoted to the production of castings in magnesium, aluminum, copper, bronzes, brasses, cast iron and all alloys of steel. This group is comprised of foundries operating whose objective is to use their modern mechanization and pooled efforts to produce shell molded castings of any required alloy at lowest possible prices and to only the highest quality and precision standards.

It is their intention to admit to membership more qualified foundries in strategic industrial areas as the demand for more shell castings increases.

The geography of this project includes the entire territory from the Eastern seaboard to the Midwest, comprising the industrial center of the United States. These foundries are prepared to offer industry in general the many technical advantages of the shell molding method including cost savings and in many cases, total elimination of expensive machining operations. Along this line, they will consult with designers and engineers to redesign the product so that the greatest possible advantage can be obtained.

Full details are available by writing to Shell Castings, Inc., P. O. Box 782, Erie, Pa.

TEST BARS
continued from page 56

section size and section shape and the rate of cooling through the transformation temperature.

Changes in any of these will have an important effect on the extent to which the transformations take place, that is, how close they come to reaching equilibrium, and therefore will have a very profound effect on both the properties of the test bar and the casting proper, except that the results will be different for the two.

5. *Decarburization.* This again is a problem primarily in steels where heavy sections stay hot much longer and are therefore considerably more subject to decarburization than are thin sections which are apt to cool more rapidly. This would mean that in a section which is ¼ inch in diameter, one might expect to encounter 0.005 decarburization, whereas in a section which is 1 to 2 inches in diameter, the decarburization may be as much as 0.015 deep.

6. *Oxidation.* This is a problem similar to decarburization and subject to the same variables.

7. *"Variations in grain size and structure".* This classification covers a multitude of sins, and in fact takes in almost everything which has not been specified in the list above.

All of this simply means that the real answer must be found

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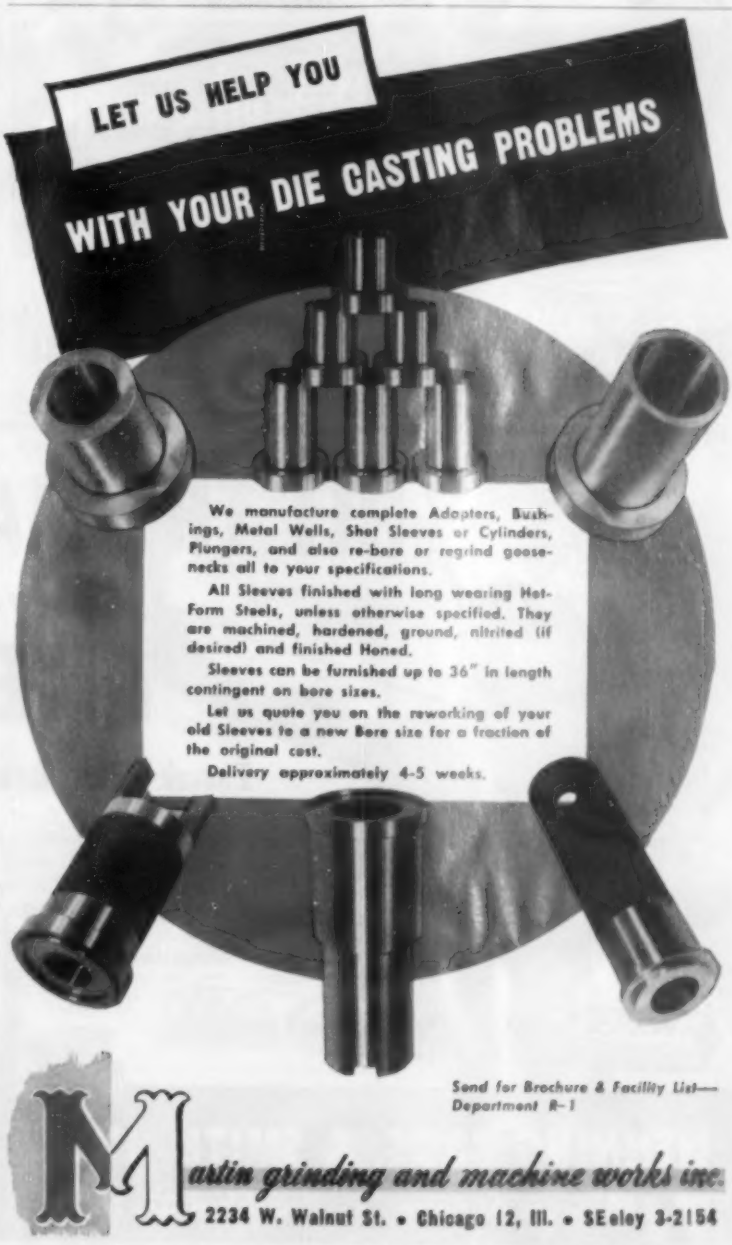
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Test Bars—Cont.

for each specific case where testing or sampling is required. There is not a simple solution which can be specified for each type of casting, and for each material. Furthermore, the investment casting foundry must find the answer in each instance and then apply this information to other cases in order to avoid earlier mistakes and to take advantage of the knowledge gained by such experiences.

It is not always necessary to cast a separate test bar. It may sometimes be far preferable to utilize the casting itself and to machine or obtain samples for evaluation or specification requirements. Sometimes it may be impossible to get a direct proportionality between the casting and the test bar. In this case new methods must be devised in order to obtain an answer.

Editor's Note: Part 2 of this paper by Dr. Nicholas Grant will appear in PMM in March, and will include several case studies comparing test results with production castings.

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